MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 36 JUNE, 1930 Number 10

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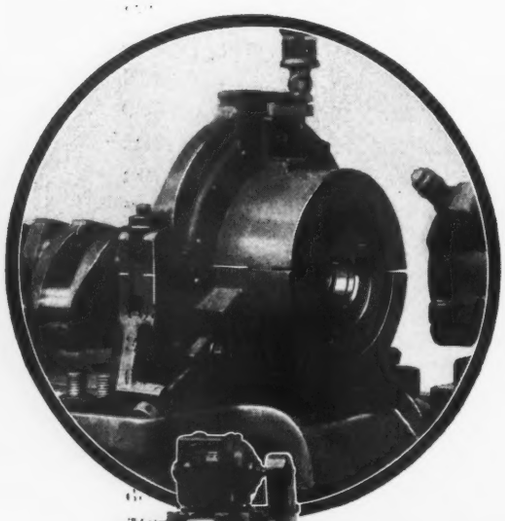
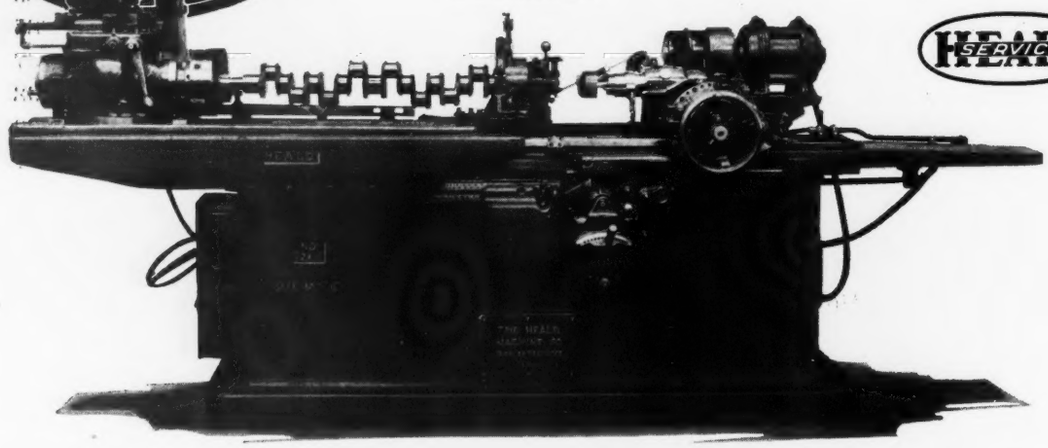
CONTINUOUSLY MEETING AUTOMOTIVE REQUIREMENTS!



Heald Size-Matic Grinds the Bearing Holes in Various Lengths of Crankshafts . . .

FOR finishing the bearing holes in the flange ends of crankshafts, Heald Service arranged a Size-Matic Internal as shown. It will accommodate various lengths and grinds the holes to size, automatically.

The hole is finished absolutely concentric with the main bearing, thus securing positive alignment between the crankshaft and the clutch shaft which is piloted in the hole of the crankshaft. So successful was the first installation that repeat orders have been placed for three additional machines.



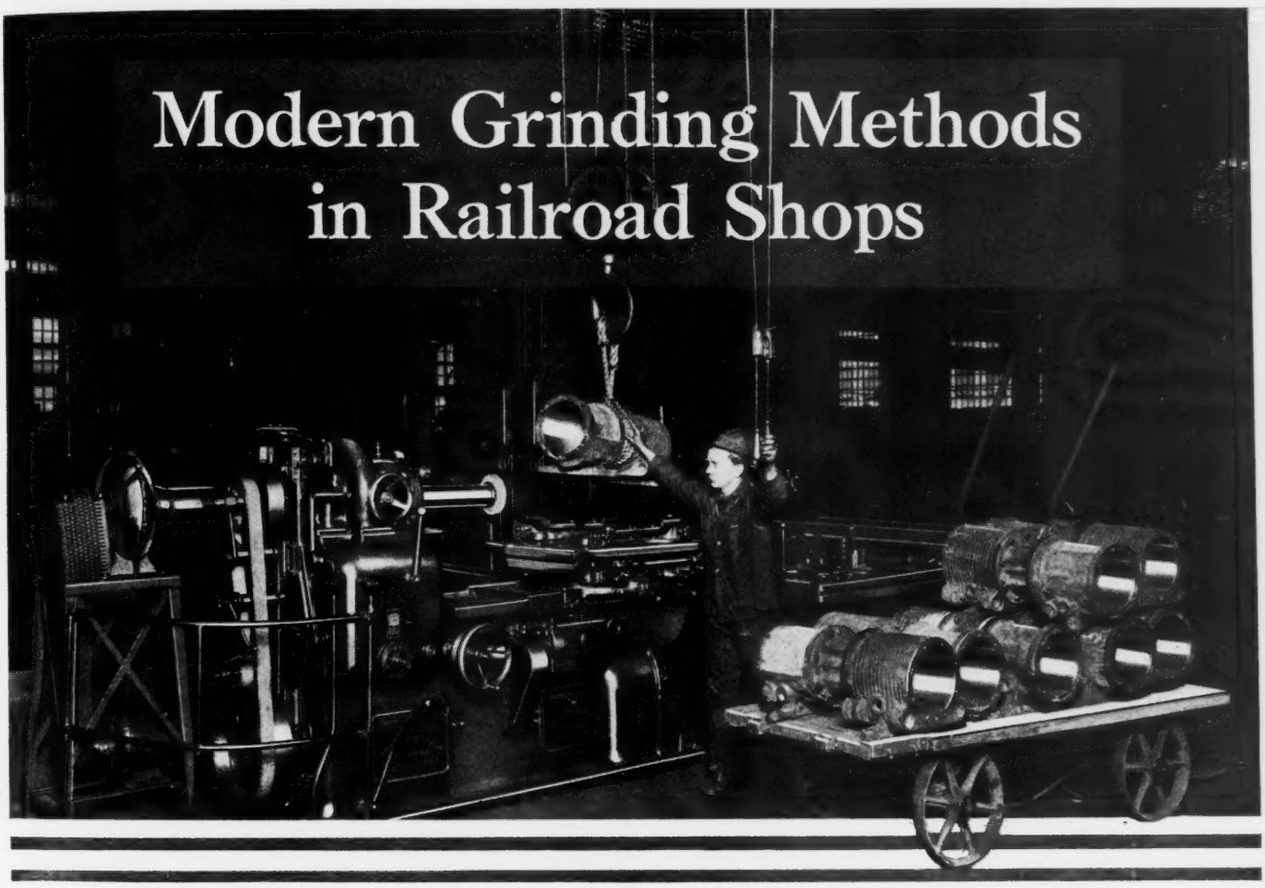
The Heald Machine Company, Worcester, Massachusetts, U. S. A.

HEALD

MACHINERY

Volume 36 NEW YORK, JUNE, 1930 Number 10

Modern Grinding Methods in Railroad Shops



The Application of Grinding to Air Pump Cylinders, Reverse Gear Cylinders, and Other Locomotive Parts—First of Three Articles

By H. H. MOOR, Micro Machine Co., Bettendorf, Iowa

DURING recent years grinding machines have found an ever widening application in railroad shops. Owing to the fact that the average railroad shop is not a production shop, in the accepted sense of the term, an important factor to be considered in the selection of railroad machine tools is the ability of the machines to handle a wide variety of work, in order that they may be kept busy most of the time. This consideration is of particular importance in choosing equipment for medium-sized and smaller railroad shops. The present article will describe a number of operations performed on a grinding machine built by the Micro Machine Co. and designed especially for a wide variety of operations on locomotive parts.

This machine was originally designed for reconditioning the cylinders of locomotive air pumps, with the cylinders assembled to the center casting, but various attachments are now available that make it possible to handle many other classes of work, including the reconditioning of bores varying in diameter from 1 1/8 to 16 inches. The examples of work here illustrated and described are from one of the leading midwest railroad shops, but similar examples of grinding practice may be found in the shops of nearly fifty American and Canadian railway systems, where these machines have been installed.

Grinding Air Pump Cylinders

The heading illustration represents a typical installation, where 9 1/2-inch single-stage pumps are being ground on a production basis. The floor-to-floor time required for finishing the cylinders of each pump is not over 2 hours; for 8 1/2-inch cross-compound pumps, it takes 4 hours or less. Eight or ten hours has been the time required in the past for boring these cylinders. This saving in time is due largely to the fact that with the grinding method it is not necessary to take the pump apart,

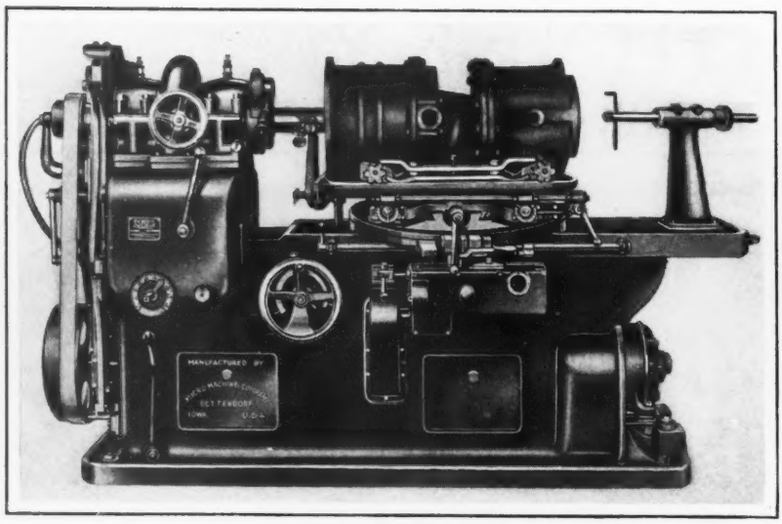


Fig. 1. Cross Compound Pump Mounted on a Swivel Fixture for Grinding

whereas on a boring machine this had to be done.

As illustrated in Fig. 1, the pump is mounted on a swivel fixture without being disassembled. There is no necessity of disturbing the gaskets, and as a result, the cost of new gaskets and approximately from 2 to 2 1/2 hours time are saved. It is recommended, however, when gaskets are leaking, that they be renewed and the cylinders reassembled to the center casting before grinding. The swivel fixture is provided with vertical and horizontal adjustments, so as to take care of the entire range of pump sizes in general use.

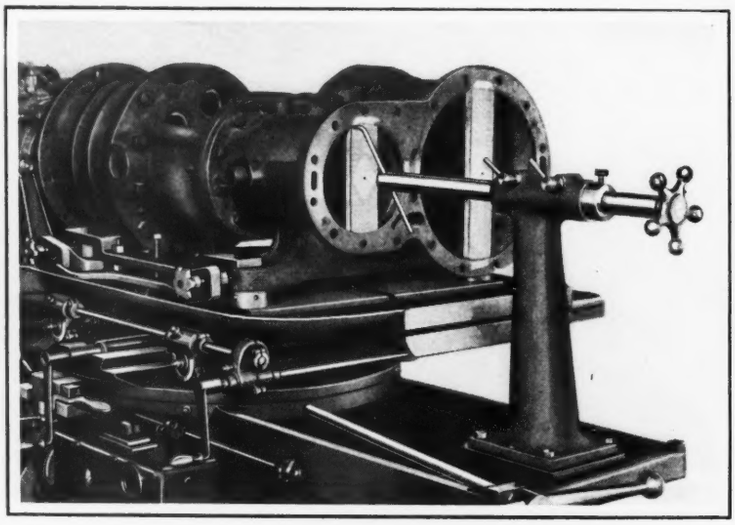


Fig. 2. Temporary Centers Used in the Cylinders for Laying-out Purposes

Setting up the Cylinders for Grinding

The grinding of the cylinders at one setting insures that they will be in perfect alignment with each other. The method employed also provides an accurate means of lining up the high-pressure steam cylinder on a common center line with the reversing valve rod. To do this, temporary centers, as illustrated in Fig. 2, should be placed in the cylinders, using a lay-out table as shown in Fig. 3. While the machine is automatically grinding one of the pumps, the operator can lay out the next one, ready for the grinding operation.

After the temporary centers are in position, the steam head is placed on the end of the pump, over the dowel-pins. A pointer which has been turned to fit the hole in the steam head and is pointed like a lathe center is then inserted through the steam head, establishing a center-punch point on the temporary center. From this center-punch point, the operator can determine whether or not the original set-up line of the pump manufacturer (or the points on the gasket face of the pump) is concentric with this center. If it is not concentric, a new line is scribed with dividers, for the set-up.

In checking this center with the counterbores of fifteen or twenty air pumps, it was found that the counterbore frequently was eccentric; hence, the counterbore is not a safe guide in setting up the pump for grinding. The manufacturer's set-up lines or points, however, may be used as a safe guide in setting up the low-pressure steam cylinders and both air cylinders for grinding. The method of laying off and setting up the pumps with the cylinders assembled to the center casting, which is made possible by the construction of the grinding machine referred to, results as already mentioned, in the cylinders of the

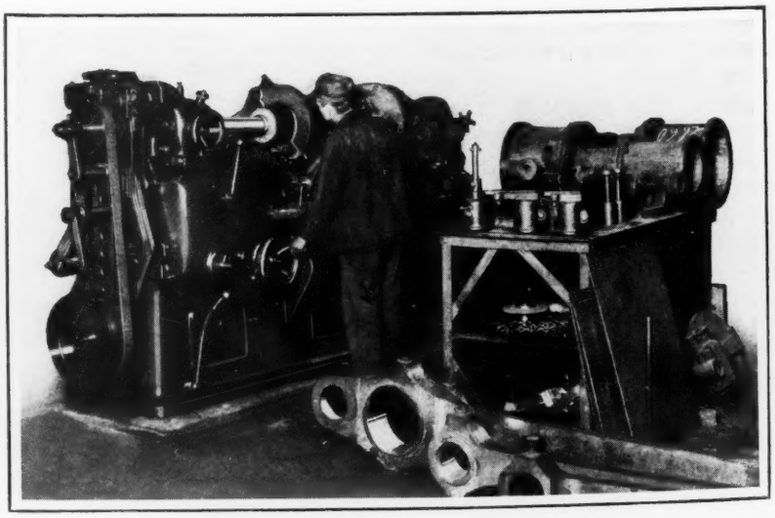


Fig. 3. Grinding One Cross Compound Pump while the Next One is being Prepared for Grinding on the Lay-out Table to the Right

finished pump being in perfect alignment, and assures that the high-pressure steam cylinder will be on a common center line with the reversing valve rod. This insures high pump efficiency, decreased operating costs, reduced shop costs, maximum length of pump life, and eliminates pump failures.

After the laying out operation is completed, the pump is set on the table of the machine, resting on four adjusting jacks located in properly spaced holes, arranged to suit the various types of pumps. Side shifting brackets are also provided. These brackets, together with the elevating jacks—combined with raising and lowering facilities in the fixture itself—provide means for quickly centering the cylinders to coincide with the centering needles of the rear pedestal and the grinding spindle. After the centering operation is completed, the pump is clamped down and all four cylinders can be ground at one setting.

Boring Cylinders Preliminary to Grinding

When it is necessary to remove a large amount of metal from the bores of the cylinders, this is done by the use of boring tools before finishing with the grinding wheel. This work can be done directly in the grinding machine, boring, beveling, and reaming tools being provided for the purpose. The boring-tool holders are clamped on the grinding spindle housing, as indicated in Fig. 4. The ends of the cylinders are also beveled for the ring entrance, and the relief at the bottom of the cylinders is cut with the same tools. Reaming of the piston-rod gland holes can also be done with tools held in the boring-tool holder. The reaming tools are made 1/32 inch larger in diameter than the piston-rods to insure clearance all around the rod.

Fig. 5 shows the set-up for a 9 1/2-inch single-stage pump. Here the side shifting and clamping facilities that make a quick set-up possible are clearly shown. The same leveling jacks, side shifting brackets, centering devices, and boring, beveling, and reaming tools are used on all types of air pumps.

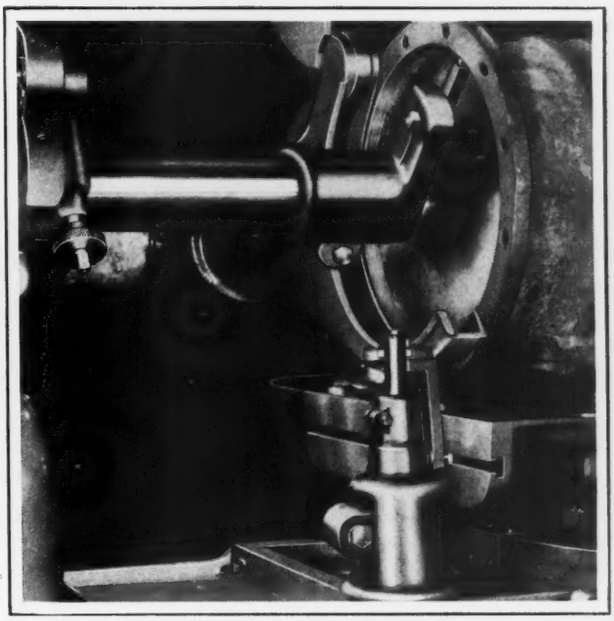


Fig. 4. Tool-holders and Tools for Boring and Beveling the Cylinders and for Reaming the Piston-rod Gland Holes

Advantages of Ground Cylinder Bores

A comparison of the surfaces produced by boring and grinding may be made by reference to Fig. 6. As the grinding wheel is composed of thousands of cutting points, it removes the metal with a minimum of pressure against the cylinder wall. Because of this light pressure, the accuracy of the grinding operation is not affected by the thickness of the walls, hard spots, or similar conditions, and the resulting bore is always straight and round. The small amount of stock removed also permits the pumps to be reconditioned more times than would be possible if the cylinders were rebored. The smoothness of the ground surface not only permits a closer fit of the pistons and rings, but also reduces wear to a minimum and increases the efficiency of the pumps.

The method of grinding described, which prevents misalignment because the pump is not taken apart, is also of great importance in maintaining pump efficiency. In tests conducted by the Micro Machine Co., it has been found that piston-rods do not always travel in a straight line when the cylinders have been taken off the center casting and bored. This misalignment necessitates that the piston-rod packing be kept excessively tight, which, in turn, results in great wear on the piston-rod and the packing. Difficulty from this source is avoided by not taking the pumps apart.

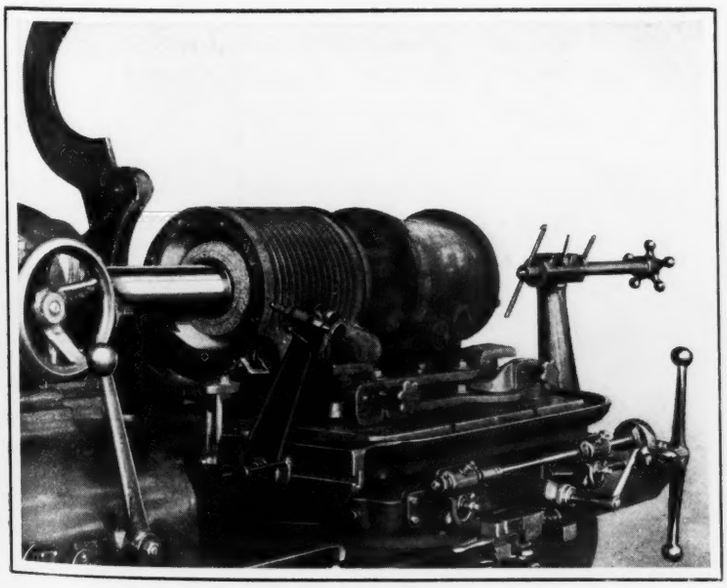


Fig. 5. Grinding a 9 1/2-inch Single-stage Air Pump

Grinding Reverse Gear Cylinders

The fixture illustrated in Fig. 7 was designed to support all types of American-

made reverse gear cylinders and circular guides while grinding. This fixture is mounted on the swivel table, as shown in Fig. 8, in the same way as an air pump, with the fixture resting on and leveled up by the pump elevating jacks. The long grinding spindle shown in Fig. 7 will reach through all types of reverse gear cylinders and circular guides except the one known as "Raggonet A," which is unusually long; but the spindle extension also shown in Fig. 7 may be used for grinding this very long cylinder.

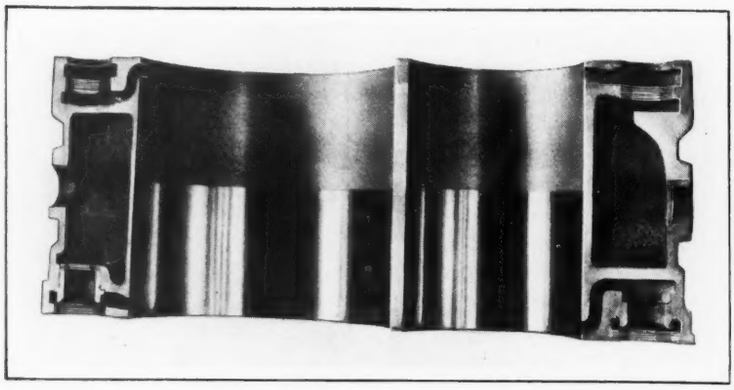


Fig. 6. Section of Cross Compound Air Pump, Showing Half of the Cylinders Finished by Boring and Half by Grinding

Fig. 8 shows what is known as the "Alco E" cylinder, with the circular guide attached, mounted in position for grinding. After the cylinder has been finish-ground, the fixture is swiveled 180 degrees and the circular guide is ground, as shown in Fig. 9. This method makes it unnecessary to remove the circular guide casting from the cylinder and insures perfect alignment of the piston with the circular cross-head.

Grinding the Holes in Side-rods

Auxiliary equipment is used for mounting side- and main-rods, various valve motion parts, fire-door cylinders, bell-ringer cylinders, and other locomotive parts when these are to be ground. That a rigid mounting is necessary for the best results in grinding long and heavy parts is obvious; hence, as shown in Fig. 13, when side-rods are ground, the weight of the rod is carried on a specially designed roller stand. The pedestal by which the weight of the rod is directly supported is adjustable in and out for varying lengths of rods. It can also be adjusted up and down as required. This roller stand carries practically the entire weight of the rod, thereby relieving the machine from undue strain.

This method of mounting the rod for grinding makes a quick set-up possible.

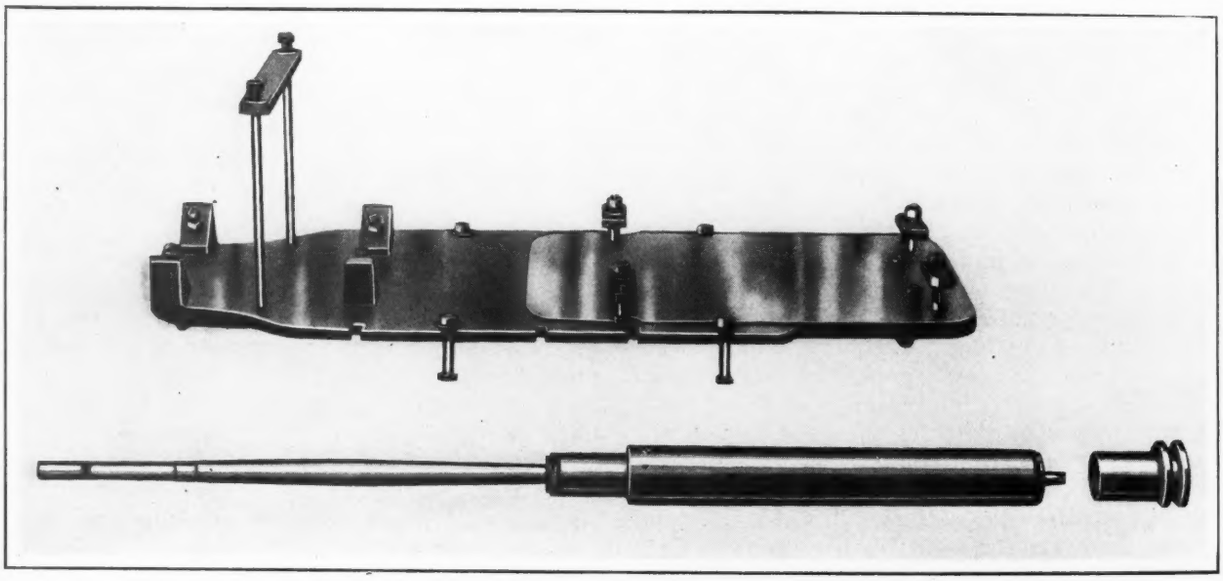


Fig. 7. Equipment for Grinding Reverse Cylinders and Circular Guides

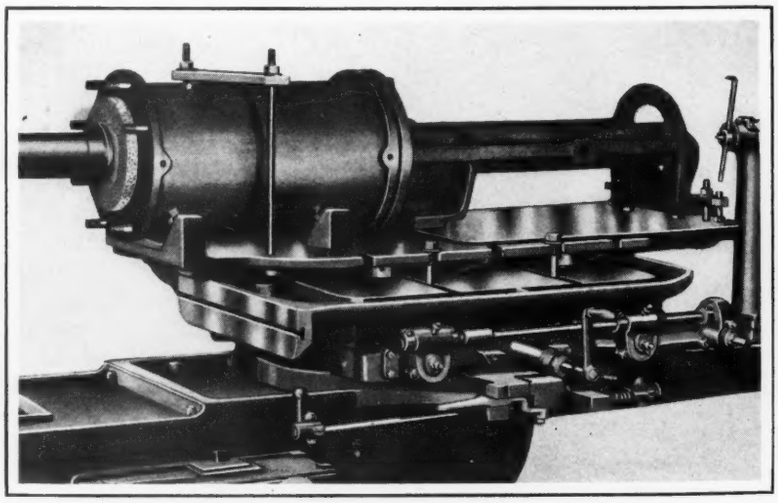


Fig. 8. Grinding an Alco Reverse Gear Cylinder

The operator does not need to support the end of the rod, so that his hands are left free for clamping after the rod has been placed on the machine by the crane.

The cross-lines on the face of the angle platen are used for centering the rod eye relative to the grinding circle. These lines are cut deep enough to clean the grit on the parallel spacer bars when they are slid from one position to another. The vertical and cross adjustments of the swivel table make it possible to adjust the rod quickly relative to the grinding wheel.

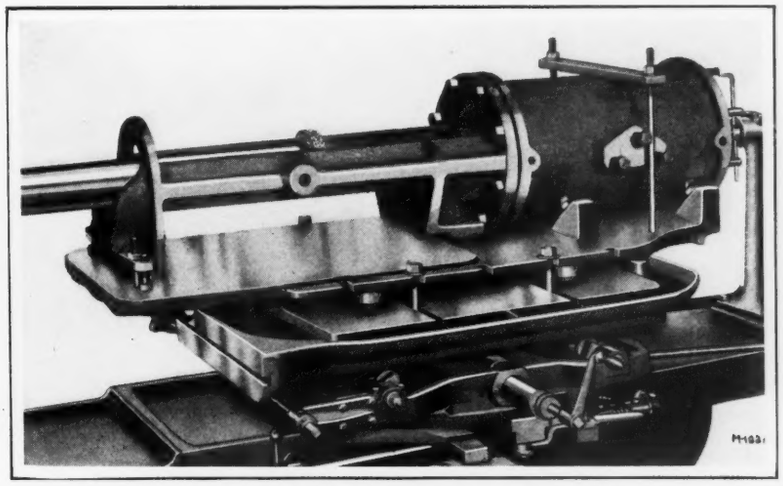


Fig. 9. By Merely Swiveling the Fixture in Fig. 8 through 180 Degrees, Circular Guide can be Ground in True Alignment

Unsatisfactory results are obtained by attempting to suspend the rod from overhead gib or monorail cranes, as it is likely to move during the grinding operation, due to the vibration caused by traveling cranes, lineshafting, etc.

The wide use of floating bushings for rod bearings has increased the necessity for ground holes that are accurate and exceptionally smooth. By the grinding method, a minimum of stock is removed from the rod eye, insuring many more overhaulings than would be possible with the boring method, as it is necessary for the boring tool to cut deep enough to get below the glazed surface. Several railroad shops that are finishing rod holes by grinding state that hot rod bearing troubles have been practically eliminated since the introduction of the grinding method and that the mileage between overhaulings has been considerably increased.

Small spindles are provided for the grinding of small and long bushings. The smallest spindle available will grind down as small as 1 1/8 inches in diameter by 6 inches deep, while a larger and longer spindle is used for grinding such parts as fire-door cylinders. This spindle will also reach through both sides of a valve-stem cross-head.

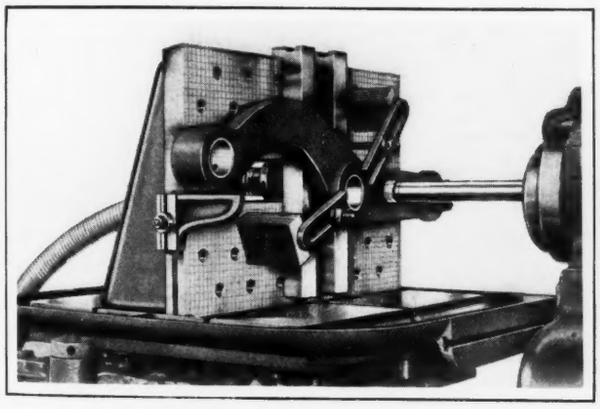


Fig. 10. A Baker Connecting-rod Mounted on Closely Spaced Parallel Bars

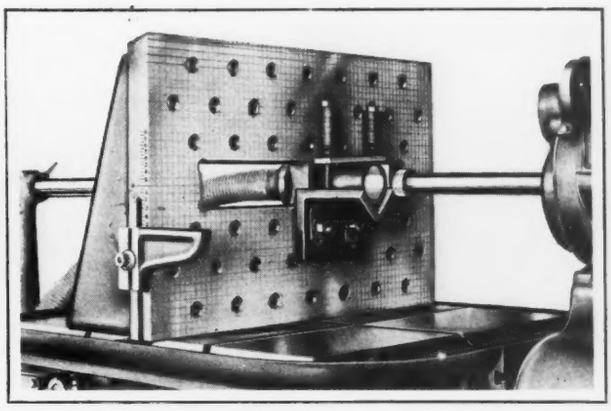


Fig. 11. V-type Angle-plate Providing a Quick Set-up for Grinding Bushings

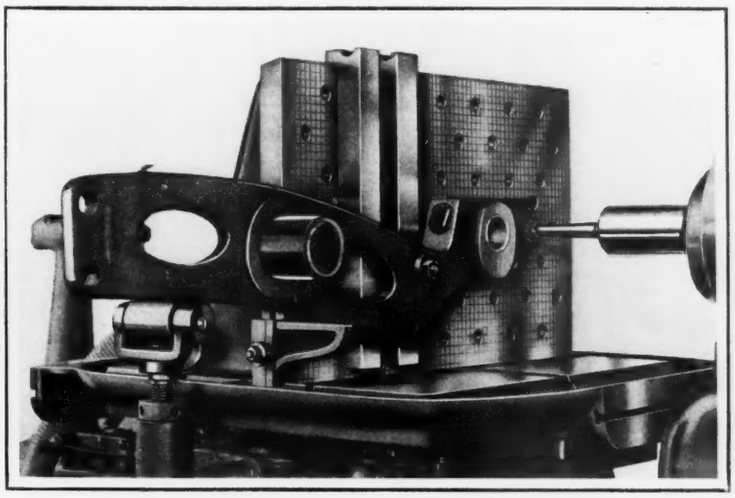


Fig. 12. Mounting a Walschaert Link Cheek for Grinding the Hole

Fig. 12 illustrates the set-up for grinding a pin hole in a Walschaert link cheek. Fig. 14 shows the set-up for grinding the long pin hole in a Baker valve rod. The vertical parallel spacer bars on the face of the angle platen, against which the work is clamped, should be noted. These parallel bars can be

spaced apart different distances to suit any type of valve motion part. Fig. 10 shows a Baker connecting-rod mounted on closely spaced parallel bars.

In many railroad shops today, it is common practice to carry finished valve-motion bushings in stock ready for immediate use. When quantities of these bushings are being manufactured, the small V-type angle-plate illustrated in Fig. 11 is used for holding the bushings during the hole-grinding operations. The outside diameter of these bushings is usually finished on a mandrel in a cylindrical grinder after the hole has been ground.

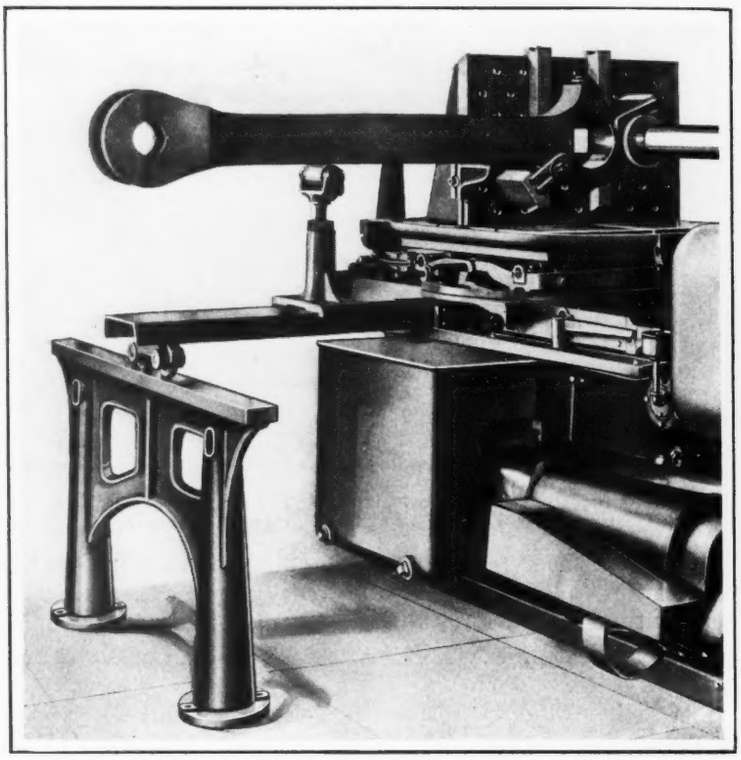


Fig. 13. Method of Mounting Rods and Other Long Parts for Grinding

In a following article, to be published in July MACHINERY, the grinding of fire-door cylinders and throttle valves, as well as a link grinding fixture, will be illustrated and described. A subsequent article will deal with locomotive crankpin grinding by the use of a portable grinder.

* * *

The Newark, N. J., Museum of Art, Science, and Industry has just acquired an exhibit of more than two-hundred mechanical movements, machine models, and driving mechanisms, which together with models of automotive engines and other machinery, will be on exhibition at the Museum, 49 Washington St., Newark, N. J., during the summer months. Practically every form of motion is portrayed in the models to be shown, as applied to the generation, transmission, and measurement of power, hydraulics, motion controlling devices, timing devices, textile processes, etc. Engineers and others interested in these subjects who are in the vicinity will find the exhibit well worth a visit.

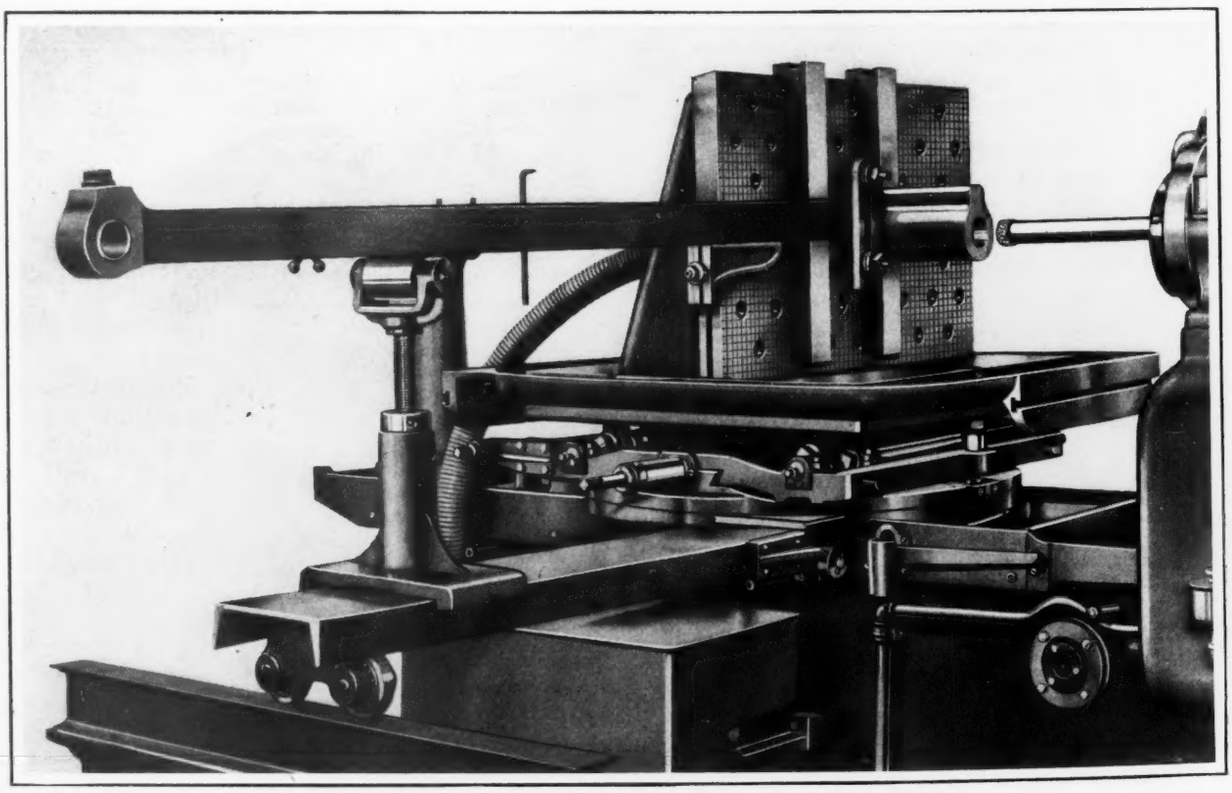


Fig. 14. A Baker Valve Rod Supported by a Side-rod Roller Stand

TWO SPIRAL GROOVES MILLED WITH ONE CUTTER

An ingenious method is employed by the Alemite Corporation, Chicago, Ill., for simultaneously milling two spiral grooves opposite each other in a small coupling. The form of these grooves may be seen in Fig. 1. Although they are only 1/8 inch wide, they are produced by means of a single milling cutter of the type shown extending across the two grooves in the manner used. The grooves are approximately 7/8 inch long.

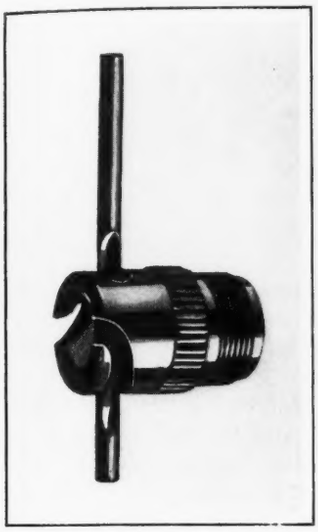


Fig. 1. Part in which Two Grooves are Cut Simultaneously

This groove-cutting operation is performed in gang drilling machines of the type illustrated in Fig. 2. Each cutter is held in a Jacobs chuck, and is piloted in bushings at three points—in the middle of the work, above, and below. While the cutter is turning at a speed of 1260 revolutions per minute, the piece is gradually advanced and at the same time is swiveled to give the desired path to the grooves. The cutters have two sections of spiral flutes with a guiding surface between. When the fine cutting edges become dull, the cutters are discarded, because they cannot be conveniently resharpened.

Each work-piece is held by means of an expanding arbor on which the piece is slipped until an internal shoulder comes in contact with a mating surface on the arbor. The arbor is contracted when the operator grasps a handle, and automatically expands as the handle is released. After a piece has been loaded in the manner described, the operator merely engages a worm with a worm-wheel to start the forward speed of the work-spindle toward the cutter. During the advance of the spindle, it is slowly swiveled, to give the proper shape to the grooves, by a pin on the spindle which engages a cam groove in a sleeve. Upon the completion of the operation, the driving worm of the work-spindle is disengaged and the spindle is withdrawn rapidly by means of a counterweight. The tool revolves continuously and has no vertical movement between operations.

Several gang drilling machines equipped as described are installed in a row, so that one man can keep five units in operation. Each unit produces an average of eighty couplings per hour, which means an hourly output of 400 couplings per man. The units are, of course, operated individually, although power is supplied to all of them from one source.

* * *

NEW MECHANICAL TRAINING COURSE

A new mechanical training course for young men in the machinery industry has been instituted by the Patterson Foundry & Machine Co. and the Patterson Steel Products Co., East Liverpool, Ohio. Two courses will be available, the professional course and the trades course. The former will fit the students for mechanical engineering, mechanical drafting, and salesmanship, and the latter will train them to become machinists, molders, patternmakers, and welders. The course is open to young men of eighteen years of age or over who have had the equivalent of a high school education. The plan is restricted to residents of East Liverpool and neighboring towns. The applicants will first be placed on a three months' probational period, during which they will be paid a nominal remuneration. Those successfully passing this period will be eligible for the complete two and one-half years' training course, during which they will be paid wages sufficient to make them independent of other support.

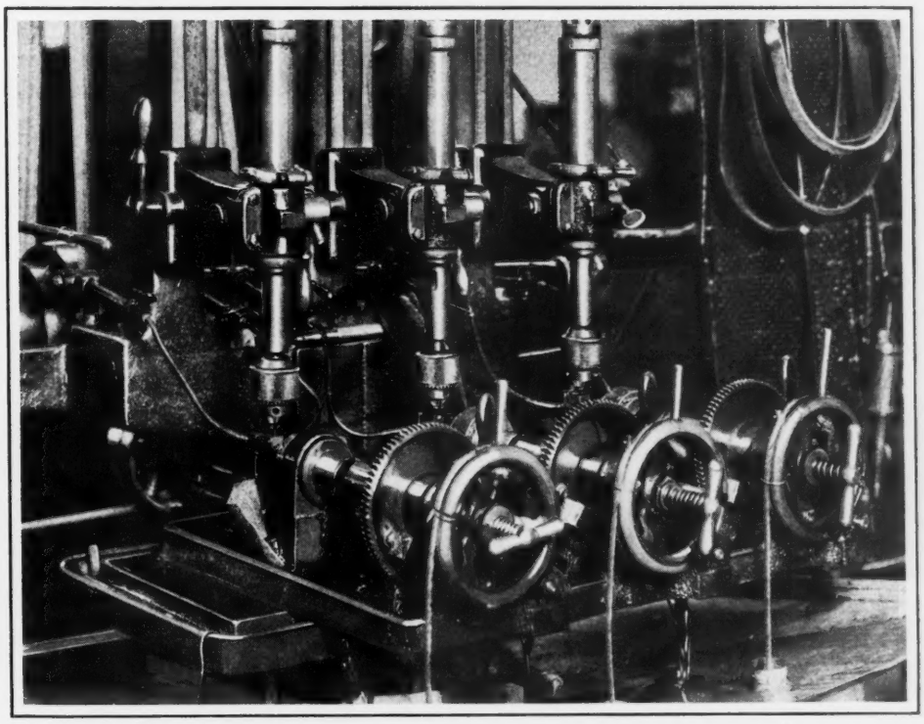
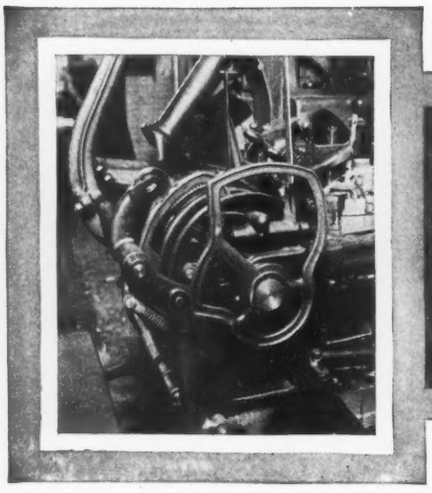
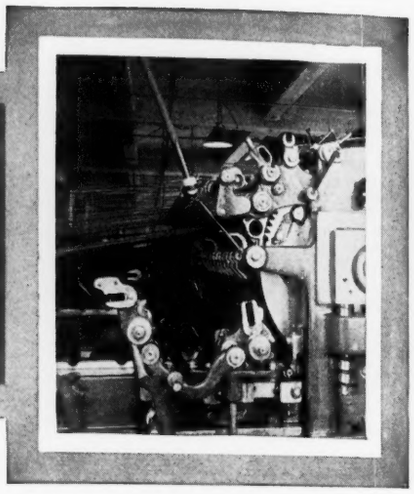


Fig. 2. Gang Drilling Machine Employed for Milling Two Spiral Grooves Simultaneously in Part Shown in Fig. 1



Ingenious Mechanical Movements



VARIABLE ROTARY MOTION

By J. S. BEGGS

The purpose of the mechanism illustrated in Fig. 1 is to produce an intermittent rotary motion which will start and stop a driven member without shock and yet keep it under positive control throughout the cycle. This motion is obtained by the practical application of the mathematical curve known as the epicycloid, which is the curve traced by a point on a circle as the latter revolves on the outside of another fixed circle.

The arm *A* is keyed to the driving shaft *B* which revolves continuously at a constant rate. At each end of arm *A* is a revolving shaft *C*, which has a revolving gear *D* keyed to one end and a short arm or crank *E* keyed to the other. The two revolving gears *D* mesh with a fixed gear *F* which is concentric with the driving shaft. All three gears are of equal diameter. At the end of each crank *E* is a roller *G*, the center of which lies on the pitch circle of the corresponding gear *D*. The circular plate *H* revolves freely on the driving shaft *B* as it is driven by rollers *G*, each of which engages a radial slot in the plate. The drive is taken from plate *H* in any desired manner.

It will be seen from the illustration that the centers of the rollers *G* trace the epicycloids shown by the broken curves in the end view. As the arm *A* rotates, the angular velocity of the centers of the rollers and of the driven plate gradually increases from the zero point at *K* until, in the position shown

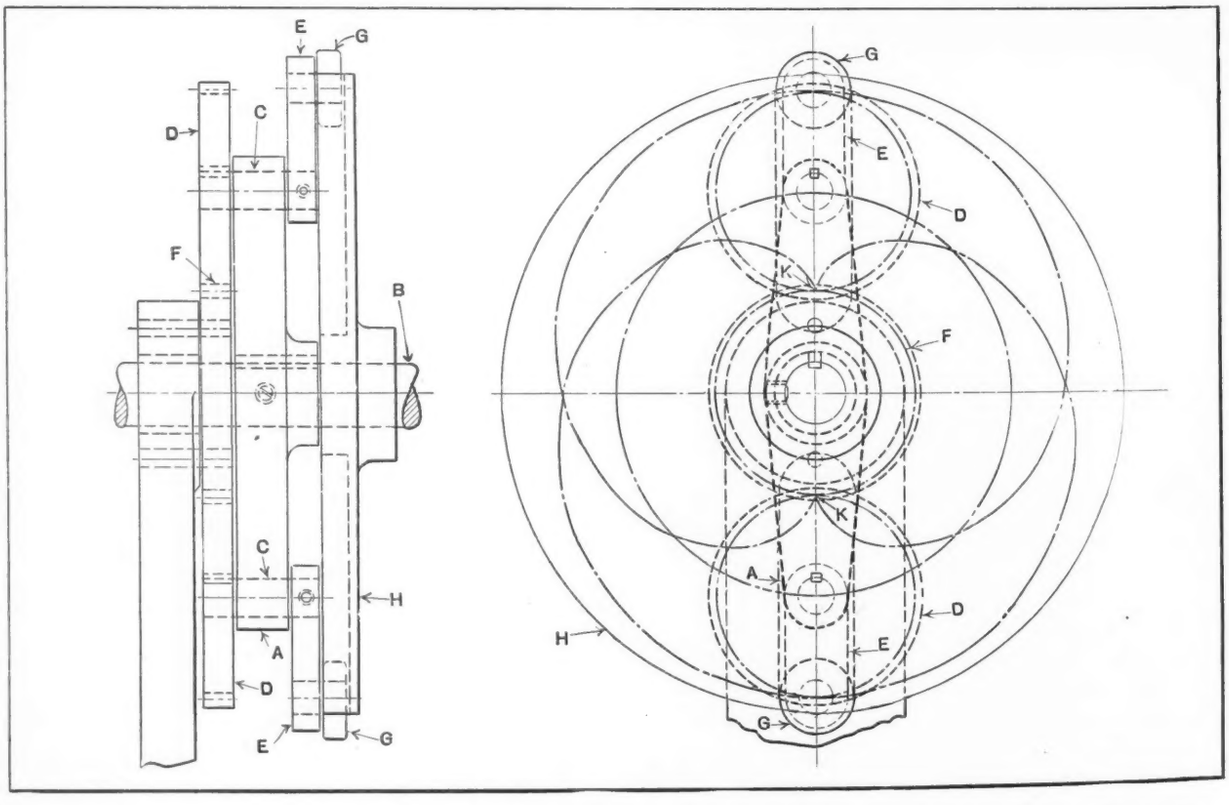


Fig. 1. Planetary Type of Crank Motion for Gradually Varying Speed of Driven Member from Zero to Maximum Velocity and Back to Zero, as Shown by the Curve in Fig. 2

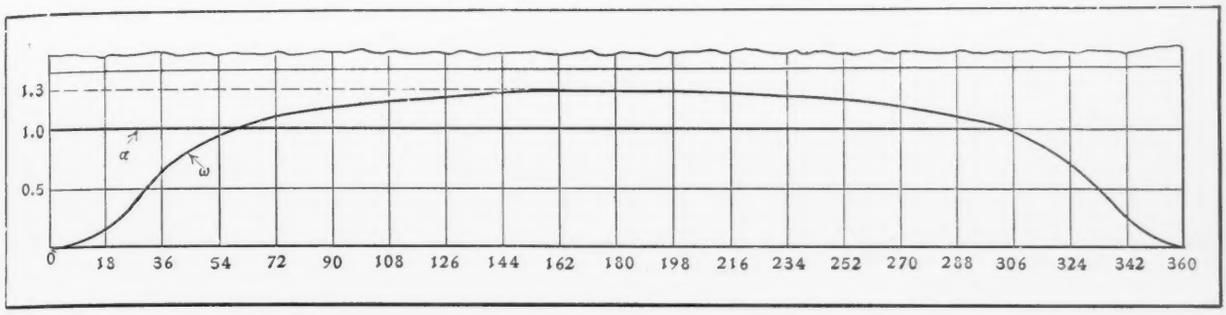


Fig. 2. Curve Showing Variation in Velocity of Driven Member of Mechanism Illustrated in Fig. 1. Figures at Base of Diagram Show Angular Position of the Driving Shaft in Degrees

in Fig. 1, the angular velocity is greater than that of the driving shaft; from this point and during the following half revolution of the driving arm, the angular velocity of the roller center and of the driven plate is gradually reduced again to zero at point K. Since the gears are of equal diameter, the roller centers and the driven plate make a complete revolution in the same time as the driving shaft.

Fig. 2 is a graph showing the relation between the angular velocity of the driving shaft, which is constant, and the driven plate for various positions of the driving shaft throughout one revolution. The figures along the base of the diagram represent the angular position, in degrees, of the driving shaft and arm A. It will be seen that the slope of the curve ω, which is a measure of the acceleration and therefore of the stress in the mechanism, is nowhere excessive. The straight line a represents the angular velocity of the driving arm A, Fig. 1. If θ equals the angular position of the driving arm from the zero point K, Fig. 1, and ω equals the angular velocity of the driven plate H, then $\omega = \dfrac{6a\ (1 - \cos\theta)}{5 - 4\cos\theta}$.

As the figures at the left of the diagram Fig. 2 indicate, the maximum angular velocity of the driven plate is 1.3 times that of the driving arm.

* * *

ECCENTRIC FEED MECHANISM FOR INTERNAL GRINDER

By L. L. ROBERTS

The eccentric and differential type of feed controlling mechanism which is shown by a perspective view, Fig. 1, to illustrate the arrangement clearly, has been applied to internal grinders of planetary design, used for grinding holes in parts of such bulk that rotation is impracticable. The particular mechanism illustrated is applied to a Heald cylinder grinder which is used for grinding the king-pin hole in the front axle steering knuckle. This

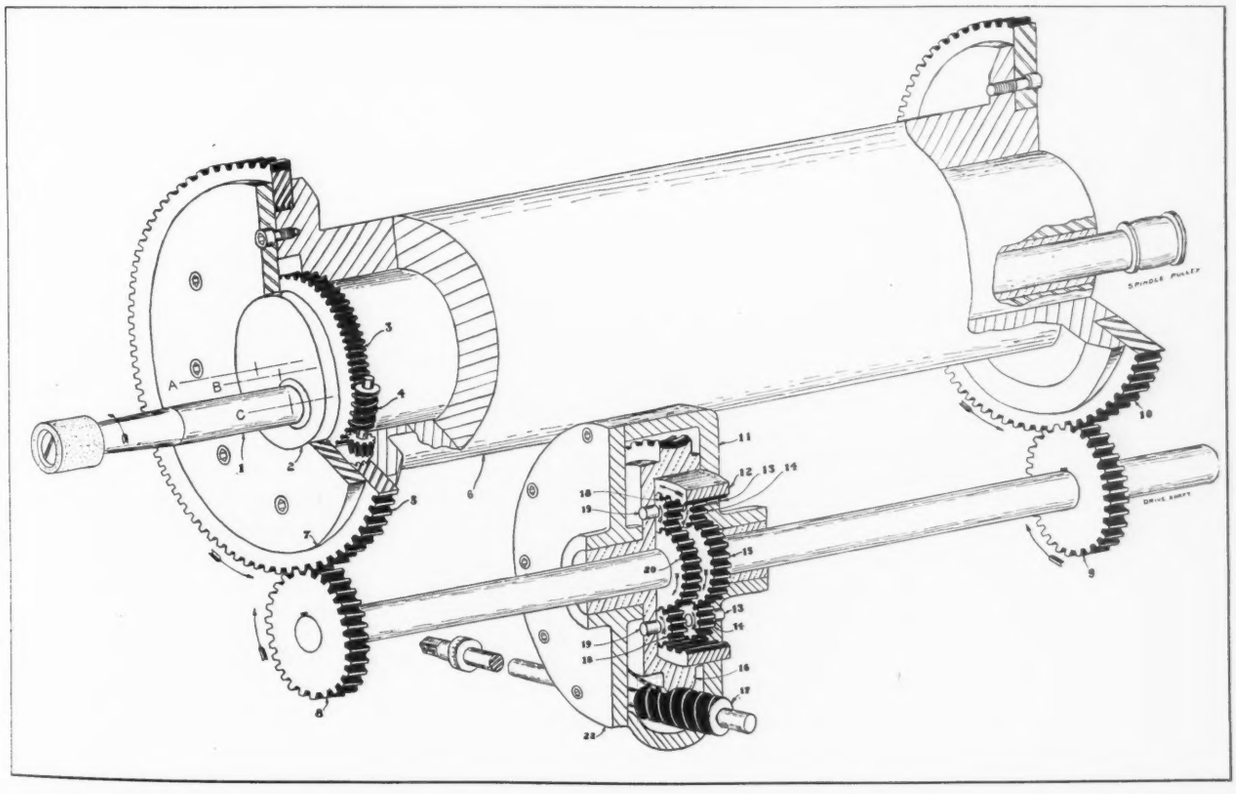


Fig. 1. Perspective View of Eccentric Feed Mechanism which is Operated by the Adjustment of Differential Gearing

mechanism has also been utilized on multiple-spindle cylinder block grinders, and it might be used on internal milling machines of the planetary type.

In the case of grinders, the radius of the path of the grinding wheel, which has a planetary motion, is changed while the wheel is at work by an adjusting movement that is transmitted through differential gearing. The grinding wheel spindle 1 is located eccentrically in a cylindrical member 2, which is rotated to vary the radial position of the wheel. Center line *A* represents the axis of the main body 6 of the grinder head; center line *B* is the axis of cylindrical part 2; and *C* represents the axis of the grinding wheel spindle. The distance

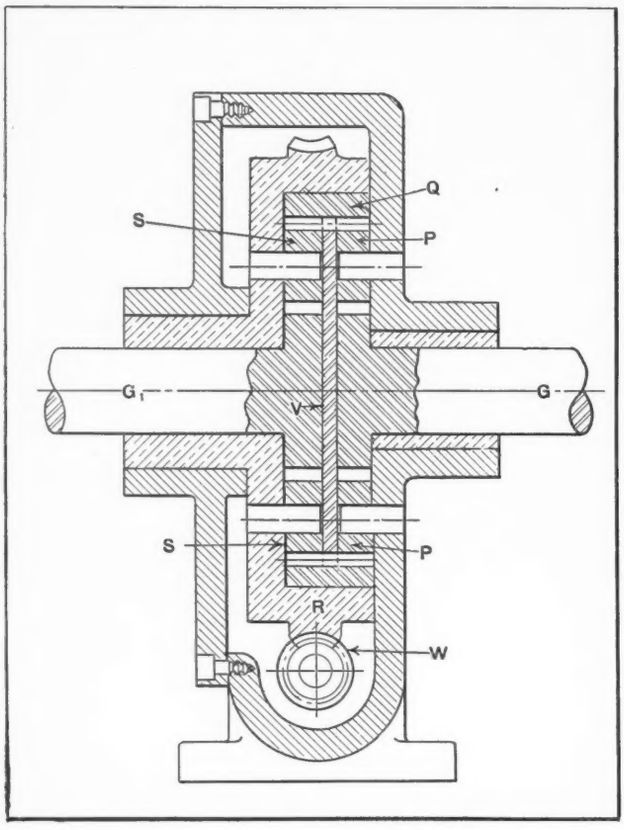


Fig. 2. Sectional View of Differential Gearing of Eccentric Feed Mechanism

from *A* to *B* equals the distance from *B* to *C*, so that by turning part 2, axis *C* can be made to coincide with axis *A*, thus permitting the wheel to be located anywhere from a central position to its maximum position radially.

When the grinding wheel has been adjusted for a given cut, it has, in addition to rotation about its axis, a planetary movement about axis *A* of the grinding head. This planetary motion is obtained from the driving shaft which rotates head 6 through gears 9 and 10 at one end, and 5 and 8 at the other. The driving gears 8 and 9 are the same size, and the driven gears 5 and 10 are also equal in size; consequently, these two sets of gearing normally rotate at the same speed, but when a feeding movement of the wheel is required, gear 8, through an adjustment of the differential gearing located between gears 8 and 9, is caused either to lag behind or advance, thus shifting eccentric 2 through worm-gearing 3 and 4 and a screw gear which meshes with teeth on the inside of gear 5.

The action of the differential gearing will be explained in connection with Fig. 2 which shows a cross-sectional view. When the driving shaft *G* revolves, pinions *P* (14 in Fig. 1) which are mounted on studs fixed in a stationary housing of the differential, also revolve. This rotation of the pinions is transmitted to the internal gear *Q* (12 in Fig. 1) which is free to turn within worm-gear *R* (16 in Fig. 1). As internal gear *Q* revolves, it drives pinions *S* (18 in Fig. 1) which are mounted on pins fixed in worm-gear *R*. Pinions *S* rotate the left-hand section G_1 of the driving shaft at the same speed as the right-hand section, except when a feeding movement occurs.

For adjusting the grinding wheel in or out, worm *W* is turned by hand, thus turning worm-wheel *R*, which changes the position of pinions *S* relative to pinions *P*. If pinions *S* are advanced or moved in the direction of the rotation of internal gear *Q*, then during this period of adjustment, shaft G_1 will turn somewhat slower than *G*; consequently, there will be a movement of gear 5, Fig. 1, relative to the main head, thus causing worm-gearing 3 and 4 to rotate and changing the position of the grinding wheel. On the other hand, if the rotation of worm-wheel *R* is such as to move pinions *S* in the direction of the rotation of internal gear *Q*, the speed of shaft G_1 will be accelerated relative to *G*, thus adjusting the grinding wheel in the opposite direction. A spacer plate or disk *V* (Fig. 2) is located within the internal gear *Q* and between the two sets of gearing. The internal teeth of gear 5 (Fig. 1) were cut on a lathe, the indexing being done by disengaging the feed-screw gears, and the teeth of the screw gear which engages the internal teeth of gear 5 were cut on a horizontal universal boring mill. The cutter used was a duplicate of the internal gear and formed the teeth by a generating action.

* * *

MACHINERY EXPORTS TO MEXICO

The United States supplies more industrial machinery to Mexico than any other nation. The total annual imports from the United States of this class of machinery have reached a value of approximately $10,000,000. American manufacturers are making practically all the new installations for sugar mills in Mexico, and are supplying a substantial part of the textile machinery. In both of these lines, British manufacturers supplied most of the equipment in the past. The question of price is the principal obstacle to further expansion of American machinery exports to Mexico. Nevertheless, according to a bulletin issued some time ago by the Department of Commerce, in most lines where European competition is the keenest, American manufacturers get the bulk of the quality business. In metal-working machinery, for instance, this country furnishes the major portion, and machine tool exports have reached important proportions.

Machining Airplane Engine Cylinder Heads

Spherical and Straight Boring, Tapping, and Facing Operations on Curtiss-Challenger Cylinder Heads Performed on a "Mult-Au-Matic"

By CHARLES O. HERB

WHEN an industrial enterprise has developed to the stage where output requirements warrant the use of high-production machinery tooled up for the interchangeable manufacture of individual parts, large reductions can generally be made in the machining time and in the cost of the parts. This important fact was appreciated fully by the engineers responsible for the manufacturing methods adopted at the new engine plant of the Curtiss Aeroplane & Motor Co. at Buffalo, N. Y.

One outstanding example of reduced machining time is the result of selecting a Bullard "Mult-Au-Matic" for taking straight and spherical boring, tapping, recessing, chamfering, and facing cuts on the cylinder head of Challenger radial-type six-cylinder engines. By former methods, the time consumed in taking these cuts was 28 minutes, whereas now the floor-to-floor time is only 1 minute 58 seconds — a reduction of about 93 per cent.

How the Saving in Time is Effected

The aluminum-alloy cylinder-head castings reach the machine in a rough state, as shown at the left in Fig. 1, except that five fins *A* have been turned and a 3/4-inch hole has been bored 5/32 inch deep into the closed end of the head directly on the center line. The bored hole in the work fits over 3/4-inch straight plugs provided at the different stations of the "Mult-Au-Matic," as shown at *X*, Fig. 3, thus seating the parts accurately, while the turned fins enable the castings to be gripped securely in the fixture stations. One-half of the fin circumference is seated against a hardened block in upright bracket *Y*, which is integral with the fixtures, while the remaining part of the fins is gripped by a similar block contained in clamp *Z*.

The station in the center of this illustration is employed solely for reloading purposes. Reloading is accomplished rapidly, as it is merely necessary to loosen thumb-nut *T* and the nut on hinged bolt *U*, and swing back this bolt and clamp *Z* to remove a casting. After a new cylinder-head casting has been placed in the fixture, these movements are reversed

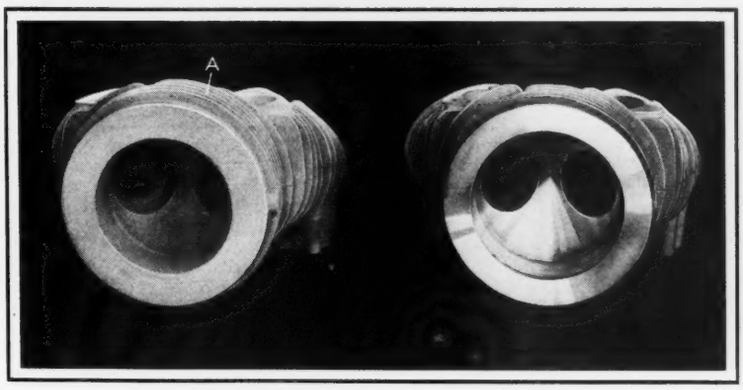


Fig. 1. Cylinder Head for Curtiss-Challenger Airplane Engine before and after being Machined on a "Mult-Au-Matic"

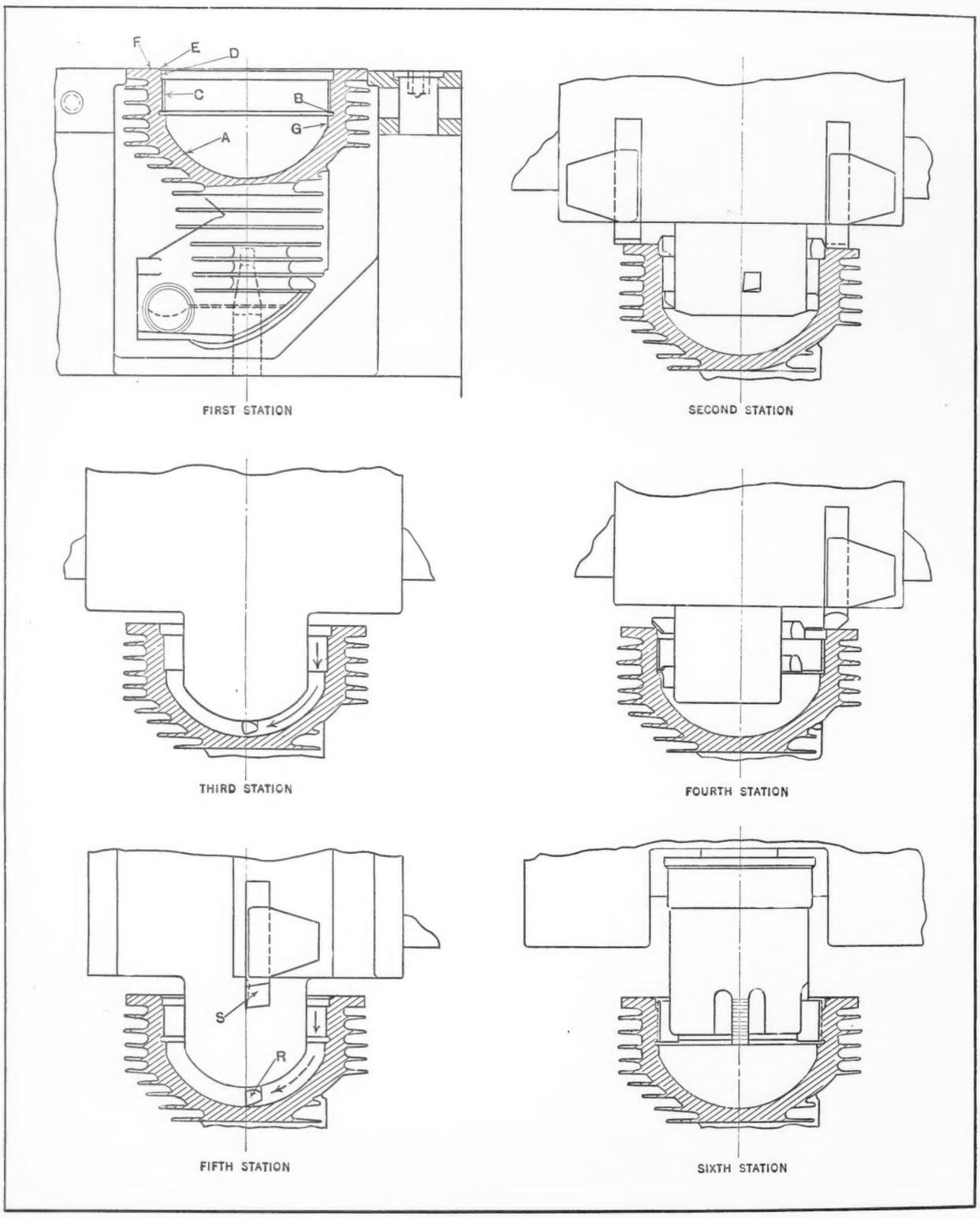


Fig. 2. Diagrammatic Views of the Cuts Taken at the Various Stations of the Machine

to hold it firmly during its travel around the machine.

Taking Rough Straight and Spherical Boring Cuts

At the second station, which is shown diagrammatically in Fig. 2 and at the left in Fig. 3, surfaces *C*, *D*, and *G* (as seen at the first station, Fig. 2), are rough-bored and surface *F* is faced. The boring cuts are taken by a flat three-step tool. Surface *F* is faced by two tools, the cutting edges of which come into contact with the surface as the boring is completed.

At this station the cylinder head makes 61 revolutions per minute, and the tools are fed at the rate of 0.0173 inch per revolution. The average diameter of the bores is approximately 5 1/2 inches. In taking the cuts, the plain tool-head of this station is given a rapid traverse of 3 3/8 inches, and then

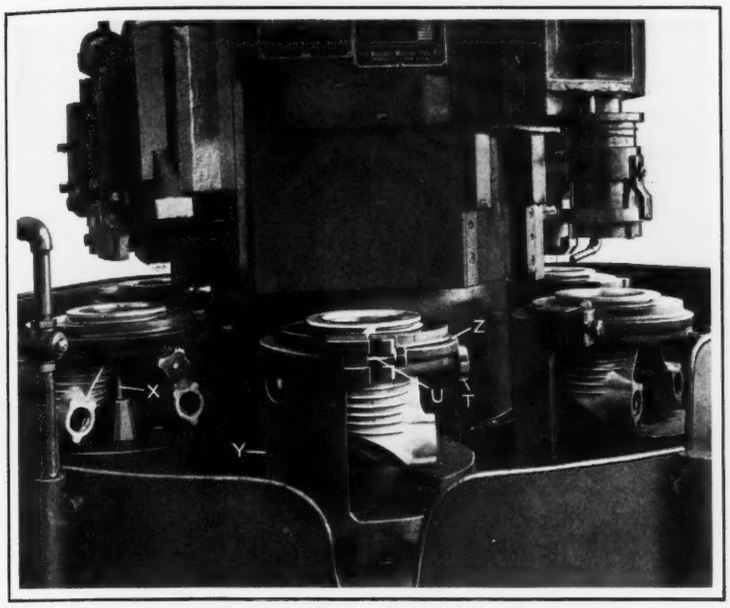


Fig. 3. Close-up View of the Loading, First Roughing, and Tapping Stations

is fed for a length of 2 3/8 inches, the entire movement being in a vertical direction.

Spherical surface *A* is rough-bored at the third station by the use of a compound tool-head which is traversed rapidly downward a distance of 4 5/16 inches and is then fed horizontally 1 11/16 inches. During the horizontal movement, the tool is swiveled to machine the surface to the required radius. At this station the cylinder head is rotated at a speed of 91.4 revolutions per minute and the tool-head is fed horizontally at the rate of 0.0093 inch per revolution.

Finish-boring, Facing, Recessing, and Chamfering Cuts

Surfaces *C* and *D* are finish-bored, surface *F* finish-faced, recess *B* cut, and corner *E* chamfered at the fourth station, illustrated at the right in Fig. 4. The tool-head employed for these operations is of a special compound type having a vertical power traverse of 7 inches, a vertical feed of 1 1/4 inches, and a horizontal feed of 1 1/4 inches. The cylinder head is revolved 75 times per minute and the tool-head is fed 0.0125 inch per revolution.

Finishing cuts on counterbore *D* and on spherical surface *A* are taken at the fifth station, which is the middle one in Fig. 4. The counterbore is finished by means of tool *S*, Fig. 2, and the spherical surface by tool *R*, which is swiveled with the horizontal movement of the tool-head in the same way as the tool employed for rough-machining this surface was at the third station. In taking the cuts at the fifth station, the cylinder head revolves at the rate of 113 times per minute and the feed is 0.0125 inch per revolution.

Tapping Constitutes the Final Cut

The final operation, performed at the sixth station, consists of cutting the internal thread in bore *C* with a 5 1/2-inch collapsible tap. This station is seen at the right in Fig. 3 and at the left in Fig. 4. Accurate feeding of the tap in accordance with the desired lead is insured by means of a cam. The tap is fitted with a shank designed to compensate for any error in cam lead. While these threads are being cut, the work revolves 30 times per minute and the tool-head feed is 0.0833 inch per revolution. The tool-head is traversed rapidly a distance of 4 5/8 inches and then fed 1 3/8 inches.

This tapping operation is a roughing one; subsequently a "sizing" tap is run through the threads by hand to insure that they will be within the close limits specified.

* * *

The use of the electric resistance welding machine for precision work, such as the welding of shanks to reamers, cutters, drills, and similar tools, where the work must be accurate within limits of a very few thousandths of an inch, is said, in a report by the American Welding Society, to have made great strides during the past year. The precision now obtainable with machines of this type is also of value in the welding of thin sheet steel, such, for instance, as band saws and similar work, where a comparatively small misalignment would cause the inspectors to reject the product.

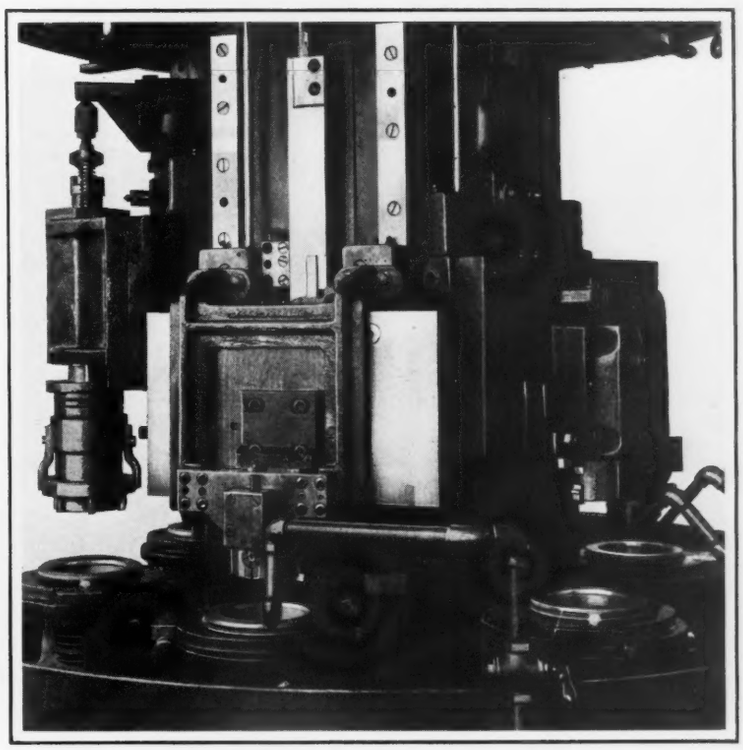


Fig. 4. View of the Two Finishing and Tapping Stations

Gear Manufacturers Discuss New Standards

At the Annual Meeting in Cincinnati, Herringbone Gears, Worm-Gears, and New Symbols for Use in Gear Formulas were Considered

THE fourteenth annual meeting of the American Gear Manufacturers' Association, held in Cincinnati, Ohio, May 1 to 3, was marked by the same thoroughgoing consideration of the problems of the gear industry as has characterized the meetings of the Association ever since it was formed. One of the important subjects brought up was that of a new standard for symbols to be used in gear formulas. The discussion was opened by a paper "Symbols for Gear Terms," presented by Allan H. Candee of the Gleason Works, Rochester, N. Y.

In the introduction to his paper, Mr. Candee mentioned that the symbols for gear terms adopted by the American Gear Manufacturers' Association in October, 1926, have not received general acceptance, especially outside of the Association, and the question has been raised from time to time as to the advisability of a change. The object of Mr. Candee's paper was to present for consideration a system of gear term symbols of the same type as is used in other branches of engineering.

The Purpose of Symbols for Engineering Terms

"Two very different ideas have been advanced as to the intended purpose of gear symbols," said Mr. Candee. "The first is that symbols are for use in formulas in technical literature—textbooks, engineering handbooks, and articles in engineering journals—and for recording calculations performed by an engineer or designer. This is obviously the purpose of the symbols that have been and are being standardized in other branches of engineering.

"The second idea of the purpose of gear symbols is that they are for use in correspondence, specifications, orders, information on shop drawings, etc. These two distinct purposes may be designated as the technical and the commercial." The technical group includes the engineer, designer, engineering professor and student, and technical author. The second group includes, in a general way, the salesman, purchasing agent, draftsman, foreman, and shop man.

The interests of these two groups apparently are so different that the type of symbols meeting the requirements of one are not acceptable to the other; but the question was also raised as to whether it is desirable and safe to use symbols at all in business correspondence and in transmitting information to the shop. Many would hesitate to use symbols in that way, and this practice is not at all general.

Mr. Candee advocated that the technical purpose of symbols be the one considered, and he proposed a set of symbols in conformity with general engineering practice. A committee will consider his proposal and make definite recommendations at a coming meeting.

B. F. Waterman of the Brown & Sharpe Mfg. Co., Newly Elected President of the American Gear Manufacturers' Association

The manufacturers visiting Cincinnati to take part in the annual meeting were welcomed at the first general session by John Christensen, president of the Cincinnati Gear Co. A. F. Cooke, vice-president of Gears & Forgings, Inc., and president of the Association, then opened the meeting by briefly referring to the important work before the convention. At the meeting, a report of the worm-gear committee, giving standard formulas for calculating worm-gearing, was adopted. The committee on herringbone gears submitted a progress report that was very thoroughly discussed by the members engaged in that branch of the industry.

A paper on load and speed conditions of worm-gear drives was presented by Emil Dukes, chief engineer of Gears & Forgings, Inc. This paper was a continuation of one on the same subject presented by Mr. Dukes at the Philadelphia meeting last fall. The object of this paper, and of the experiments conducted in connection with it, is to arrive at some reliable method of calculating worm-gearing and of establishing definite formulas for the power transmitted by worm-gears. Mr. Dukes' paper gave evidence of a great deal of carefully conducted experimental work and established several important conclusions, but he made it clear that the work is not yet completed and that the final formulas cannot be established until a great deal of additional experimental work has been conducted.

A paper on the photo-electric cell was presented by L. R. Koller of the General Electric Co., in which he briefly described the general action of the photo-electric cell and pointed out its important industrial applications.

Research Needed on the Application of Tungsten-carbide Tools

Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, addressed the meeting on the problems common to all machinery industries. He emphasized, first, the need for a general machinery association, and then brought out the importance of research on the new tungsten-carbide tools. That there is great need for research in this field there is no doubt; the industry does not know exactly what the possibilities of the new tools are. It is not reasonable, however, to expect that the builders of machine tools, who form a comparatively small part of the entire machinery industry, should bear the expense of such research. This is rather a matter for the entire industry—the users of machine tools, rather than the builders. The cost of such research would probably run into large figures—possibly half a million dollars. Taylor's experiments, which benefited the entire machinery industry, conducted twenty years ago when the value of the dollar was much greater than it is today, cost several hundred thousand dollars.

Fluctuations in the Machine Tool Industry

Mr. DuBrul also called attention to the wide fluctuations in the demand on industry in peak periods and in periods of depression, and pointed out that these fluctuations are especially marked in the machine tool industry, which is further removed from the ultimate consumer than the industries that make use of machine tools. In the early part of 1929, for example, the machine tool industry could only partially meet the demands for early deliveries by running over-time and night shifts, but during the entire period from 1921 to 1927, the average employment of machine tool building plants was not more than 50 per cent of one-shift operation; it is not unusual in this industry for orders to fall off one-half within a couple of months—in fact, this happened from October, 1929 to December in the same year.

These conditions cause unemployment, increase costs, and create difficult economic problems for both employers and employes. Hence, anything that will steady employment is of the greatest importance to all industries.

Good Managers Buy Equipment in Dull Seasons

Carnegie used to expand his plants when conditions in the industry in general were dull. In this way, he was able to make his new installations with minimum interruption of production and was also able to obtain prices and deliveries that he could not expect in peak periods. Forward-looking managers of industrial plants today could well follow this policy. In years of prosperity, a financial reserve could be set aside to be used for rehabilitation of plant and equipment when business is quiet. Incidentally, this would help to reduce unemployment, and would maintain purchasing power and keep business on a more even keel than is otherwise possible.

Finally, Mr. DuBrul laid stress on the point that we should not be afraid to face the facts as to whether business is good or bad. To be blind to the facts is to invite difficulties. The more openly and freely we discuss business problems, the fewer problems there will be to discuss.

Business Recognizes New Responsibilities

At the annual dinner of the Association, Frederick A. Geier, president of the Cincinnati Milling Machine Co., made an inspiring address dealing with the responsibilities facing manufacturers—responsibilities that are broader in scope than the problems of mere production. He called attention to the fact that manufacturers are recognizing more and more their obligations to their employes and to the community, and laid stress on the fact that as manufacturers in general pay more attention to this part of their responsibility, many of the difficulties that have beset our industries in the past will be eliminated. W. P. Calhoun, professor of finance at the University of Cincinnati, made an address on the credit situation.

New Officers Elected

The officers of the American Gear Manufacturers' Association for the coming year are as follows: President, B. F. Waterman of the Brown & Sharpe Mfg. Co., Providence, R. I.; first vice-president, E. W. Miller of the Fellows Gear Shaper Co., Springfield, Vt.; second vice-president, John Christensen, Cincinnati Gear Co., Cincinnati, Ohio; treasurer, Warren G. Jones of the W. A. Jones Foundry & Machine Co., Chicago, Ill.; secretary, T. W. Owen, Cleveland, Ohio. H. E. Eberhardt of the Newark Gear Cutting Machine Co., Newark, N. J., was made an honorary member of the board of directors for life. F. W. England of the Illinois Tool Works, Chicago, Ill., was elected a new member of the board of directors; and A. A. Ross of the General Electric Co., A. F. Cooke of Gears and Forgings, Inc., and Warren G. Jones of the W. A. Jones Foundry & Machine Co., were re-elected directors.

* * *

NEW FLOORING FOR MACHINE SHOPS

A new flooring for machine shops that is said to have met with great success in Europe has recently been introduced in America by Duromit Floors, Inc., 27 E. Water St., Cincinnati, Ohio. The new material is known as "Duromit," and consists of a special aggregate which, when mixed with cement and water, produces floors that are said not to check or pit under the heaviest kind of traffic. Neither will this kind of floor absorb oil or grease, and it may therefore be expected to last longer than other floors, because it will not disintegrate from such absorption or from water seepage. This type of floor is also suitable for rolling mills, shipping platforms, foundries, and similar plants. For use in lobbies and showrooms, and for safety stair treads, it may be colored, rubbed down, and polished.

Temperature Control for Hardening Furnace

Separate Thermostatic Controls for the Heating Furnace and Hardening Bath Light Colored Electric Lamps to Indicate Temperature

WHEN a number of pieces are being hardened at one time, difficulty is often experienced in obtaining the same degree of hardness in each piece. This element of uncertainty, however, is almost entirely eliminated by the use of electric furnaces of the lead bath type, which have separate thermostatic controls for the heating unit and the bath. One of these furnaces, described in a paper by Wirt S. Scott of the Westinghouse Electric & Mfg. Co., is used for hardening the cutting edges of axes, as shown in the illustration.

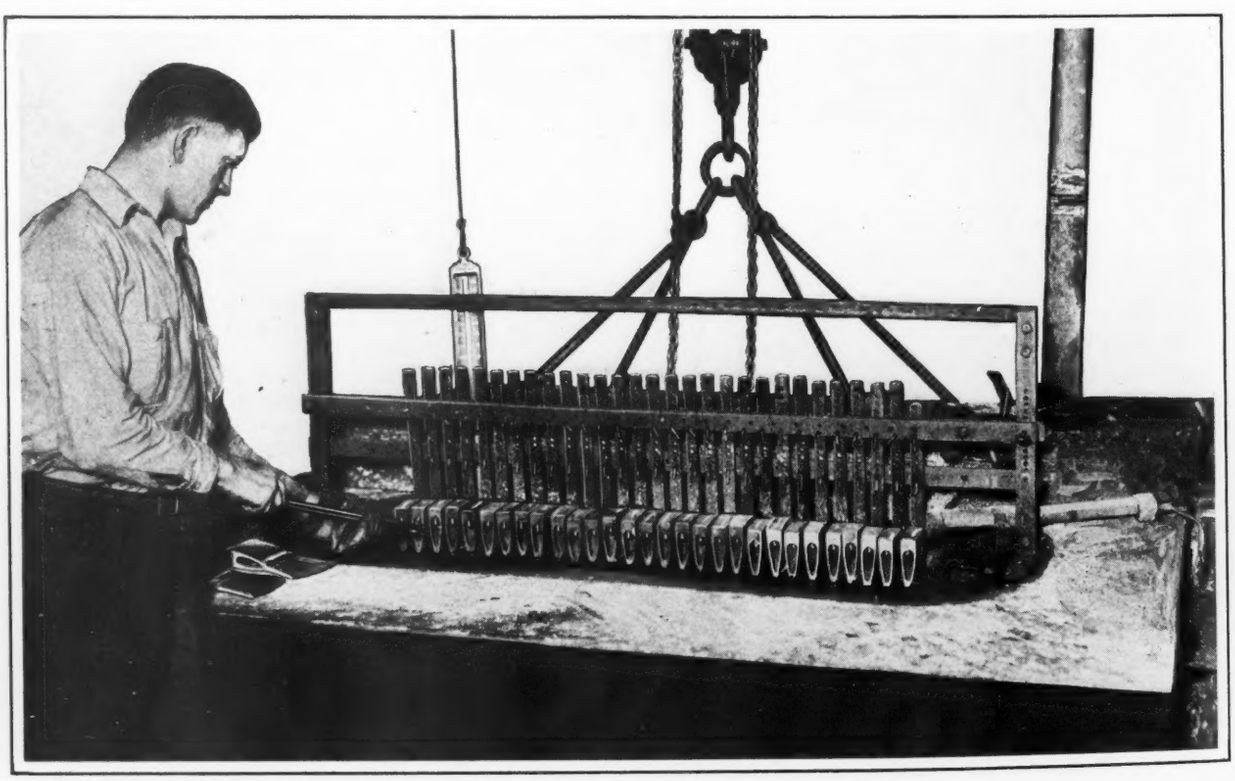
The furnace is of rectangular shape, riveted and welded together and lined on the inside with insulating material to form a heating chamber. The heating units consist of two coils of nickel-chromium resistors. The container for the bath is made of a cast-nickel chromium alloy, supported by means of a flange resting on the insulating material, over which is laid a steel top plate to prevent the molten lead from entering the heating chamber.

The axes, suspended by suitable hooks from a rack secured to the top plate, have their cutting edges immersed in the lead, which is kept at a temperature of about 1405 degrees F. The bodies of these axes are forged from low-carbon steel to which the cutting edge is welded. The latter consists of high-carbon crucible steel.

With twenty-three hooks suspended over the furnace, twenty-two of which are always loaded, the operator removes one heated axe, quenches it, and replaces it with another axe to be hardened. A clock is provided to gage the time each axe is held in the bath. The period varies from five to eight minutes, depending on the weight of the axe. Over 1400 axes a day can be hardened in this furnace.

In a furnace of this general type, the temperature of the bath does not change immediately with that of the heating chamber. To offset this condition, a thermo-couple was installed in the bath and another in one of the coils in the heating chamber. With this arrangement, the thermo-couples cut off the current at a predetermined temperature, thus preventing an excessive amount of heat from being absorbed by the bath. This system of control can be depended upon to hold the temperature of the bath to within plus or minus 15 degrees.

The immersion of cold axes in the lead at irregular intervals also affects the uniformity of the bath temperature. To regulate the movement of the axes through the furnace, special electrical signals were incorporated, consisting of three lamps placed over the furnace and connected to the pyrometer. The lamps are colored white, blue, and red. A white



Electric Furnace in which Bath Temperature is Regulated by Means of Colored Lamps

light indicates the correct temperature, a blue light too low a temperature, and a red light too high a temperature. A white and a blue light together indicate a downward swing in the temperature, while a white and a red light show an upward swing. The operator must work at such a rate as to keep the white light burning. If a blue light comes on with the white, the operator must slow up; if a red light comes on with the white, he must work faster. If the white light goes off entirely, indicating that the temperature is too low for hardening purposes, the operator must cease work until conditions become normal.

On the top of the molten lead is spread a blanket of granular carbon which has the effect of reducing radiation losses from the surface. It also reduces the oxidation of the lead and gives a wiping action for removing the lead globules from the axes. As the axes are removed from the furnace, they are quenched in brine and rinsed in clear water. They are then polished all over, after which they are tempered in a furnace similar to the hardening furnace described, except that instead of lead, a tempering salt, kept at a temperature of about 580 degrees F., is used. In tempering, the axes are entirely immersed in the bath to give them a blue color.

Twenty-fifth Anniversary of Automotive Engineers

The spring meeting of the Society of Automotive Engineers, held at French Lick Springs, Ind., May 25 to 29, also marked the twenty-fifth anniversary of the Society and included a Twenty-fifth Anniversary Pageant and a special session commemorating the Society's twenty-five years of activity.

In connection with the anniversary celebration, an exhibition was arranged of historic motor cars and accessories, displays of early newspaper and magazine automobile advertising, and photographs and editorial accounts of outstanding automotive events during the last twenty-five years. Early cars built by leading automobile builders were exhibited, as well as some famous engines, including the original engine built largely by hand by Orville and Wilbur Wright and utilized in some of their earlier flights. Thirty French engineers representing the Société des Ingenieurs de L'Automobile were present at the anniversary celebration, as well as a great number of men who were connected with the automobile business in its earlier stages, but who now are no longer connected with the industry.

The technical meetings included sessions on engines, bodies, transmissions, brakes, motor trucks and motor coaches, aircraft, and research. Of special interest to the machinery industries in general was the paper by E. M. Staples, R. L. Dowdell, and C. E. Eggenschwiler of the Bureau of Standards on "Bearing Bronzes with Additions of Zinc, Phosphorus, Nickel, and Antimony." Several papers were presented on gearing, including spur gears, internal gears, and constant-mesh or sliding gear transmissions. Diesel engines for automobiles were also dealt with in two different papers, and a comparative study of power plant engineering for motor cars and aircraft by H. M. Crane of the General Motors Corporation was of broad general interest. Copies of any of the papers read may be obtained by addressing the Society of Automotive Engineers, 29 W. 39th St., New York City.

SUCCESSFUL SUGGESTION SYSTEMS

The idea of inviting suggestions from the workers is being adopted by the managements of many companies, and more suggestion systems have been introduced in the industries within the last few years than ever before. The value of this practice was emphasized by C. B. Auel, manager of the employes service department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in a paper presented by him before the National Management Congress in Chicago.

The greatest difficulty with suggestion systems, according to Mr. Auel, has been to settle upon a satisfactory method of rewarding employes for suggestions. When the savings resulting from a suggestion can be accurately estimated, a percentage of the savings should be given to the man who makes the suggestion. In most cases, however, it is not possible to do this, and awards must be established in the form of prizes; these, however, should be paid in money, as that kind of prize offers the greatest incentive to most men. Even when the suggestion is not accepted in the form made, but leads to something being done that improves conditions, an award should be made.

The Westinghouse Electric & Mfg. Co. found that in order to keep up the interest of the employes in a suggestion system established for reducing waste, a new idea had to be introduced. After the most obvious suggestions have been made and the ground is fairly well covered, it is increasingly difficult to make suggestions; hence, a scheme of extra awards has been adopted. Five dollars extra is paid when five suggestions have been accepted from the same man. Ten dollars extra is paid for the second set of five accepted suggestions, fifteen dollars for the third set of five, and so on. These awards are in addition to that paid for the accepted suggestions.

One of the employes of the company has made over 100 accepted suggestions, and hence, his last extra award amounted to $100. In total he has received $1050 in addition to the amounts paid him for the 100 suggestions themselves. In carrying on an elimination-of-waste campaign, there seems to be no more effective way of enlisting the help of the employes than to adopt a suggestion system.

Current Editorial Comment

In the Machine-building and Kindred Industries

THE BROADER ASPECT OF ENGINEERING

"Before engineers can hope to realize the position that is rightfully theirs, they must arouse their consciences and recognize that they are members of society and not merely technicians." This was the message brought by Charles Piez, president of the American Society of Mechanical Engineers and chairman of the Board of the Link-Belt Co., to engineers and manufacturers at the Fiftieth Anniversary Celebration of the Society. In expressing this idea, Mr. Piez voiced a sentiment that is more and more coming to be appreciated by industrial leaders. It has become evident to them that the responsibilities of the engineer and of industry are not discharged merely by multiplying inventions, nor by building machinery for mass production, nor by applying technical skill and knowledge to an ever-increasing number of engineering problems. They recognize that the object of engineering skill and knowledge must be greater than the attainment of technical progress alone—it must include humanitarian and economic progress as well.

How widely these ideas are accepted among leaders in industry is evidenced by many other recent expressions of opinions by men who have won success in the management of industrial undertakings. Alvan Macauley, president of the Packard Motor Car Co., recently emphasized the broad responsibility of industry and engineering in solving the problem of unemployment. Frederick A. Geier, president of the Cincinnati Milling Machine Co., in a recent address before the American Gear Manufacturers' Association, and L. F. Loree, president of the Delaware and Hudson Co., in an address before the National Metal Trades Association, voiced similar ideas. President Hoover has repeatedly stated that it is just as important for the engineer and manufacturer to solve these broader problems and to apply engineering methods to them as it is to solve the merely technical problems that are, after all, only a means to an end.

* * *

NEW TOOLS IN OLD MACHINES

MACHINERY has frequently pointed out the need for using the best available cutting tools in the newer heavy-duty machine tools if the full value of the machine is to be reflected in the output. There is, perhaps, an even greater loss of efficiency in employing new, high-grade cutting tools in old, obsolete machines. The older types of machines do not have enough power to permit these cutting tools to be used to their full capacity. This applies to many types of machines, but perhaps more to drilling equipment than to any other line of machine tools. Forged high-speed steel twist drills used in an old upright drilling machine, for example, are not likely to give any higher production than a carbon steel drill. The tools and the machines should be synchronized—the machines should be as good as the tool if the best results are to be obtained.

* * *

DRAFTING-ROOM EFFICIENCY CAN BE INCREASED

A great deal has been said about wasteful methods in the shop, but not so much attention has been given to inefficiency in the drafting-room. Time is often wasted in showing unnecessary details on drawings. Our contributors frequently send us blueprints on which gears are shown with all the teeth drawn in; and sometimes, when a construction is repeated on a fixture a dozen times or more, every duplicate detail is shown on the assembly drawing.

This is wasteful practice. If a detail is repeated in a design, it is only necessary to show it completely once. In all other positions, an outline is all that is required, with a note explaining that the construction is the same.

Drawings are only a means to an end. No more work should be put on a drawing than is necessary to make the ideas of the designer clear. Waste of time in the drafting-room should be as closely scrutinized as inefficient methods in the shop.

* * *

THE PATENT LAW NEEDS REVISION

Many manufacturers feel that our patent laws and patent office procedure should be thoroughly revised to meet the needs of modern industry. The fundamental provisions of the present law are the same as those incorporated in the law over a hundred years ago. Since that time conditions in industry have changed so completely that provisions which may have been perfectly satisfactory then do not meet present-day needs.

What is required, some of these manufacturers feel, is not merely a revision of the present law, but the application of entirely new principles for the protection of inventions. It has frequently been said that a patent, as granted at present, is merely a "license to sue" and that it has little or no value until it has been passed upon by the courts. It is possible that industry would be served better by an entirely new method of patent procedure through which the patent in itself would offer a definite protection to the patentee, much the same, perhaps, as title insurance offers protection to owners of real estate.

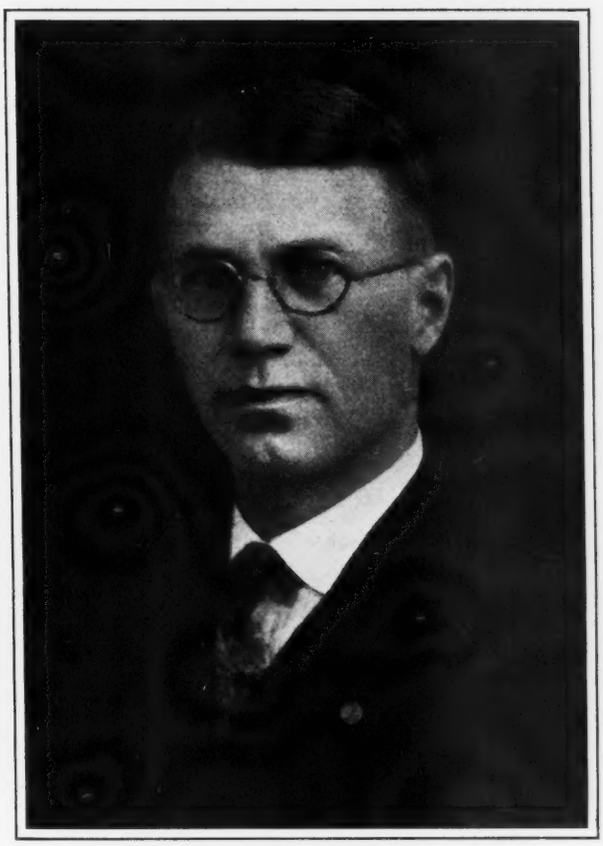
Apprenticeship, the Need of the Metal Trades

Apprentice Training is Essential to the Building of a Strong Personnel in the Metal Trades and to the Growth and Development of Industry

By HAROLD S. FALK, Vice-president and Works Manager
The Falk Corporation, Milwaukee, Wis.

IN past ages, the highest social class comprised land owners and those who followed the professions of statesmanship, war, law, and religion. All those who were in any way engaged in mechanical or commercial work, such as merchants, artisans, and sailors, belonged to a distinctly inferior social order. Those who fashioned metal, wood, cloth, or leather, or who bought and sold or transported materials and commodities of all kinds, were not permitted to associate with persons in the higher class.

With the passing of time, conditions have changed, and as a result, the business man and the manufacturer have taken a position of leadership. In many ways, manufacturing and business have assumed the aspect of a profession. The technical requirements have become as severe as in the professions. In many lines of commercial endeavor, the success attained is in proportion to the application of scientific methods. Guesswork has given way to positive knowledge, resulting from research; ethical standards have been established and are lived up to, and great educational institutions like the Graduate School of Business Administration at Harvard University are devoted to the problems and the general development of manufacturing and business.



Harold S. Falk, Vice-president and Works Manager, The Falk Corporation

However, there is one characteristic of the professions that cannot be found to any extent in the business world. I refer to the systematic efforts made to develop their man power. For hundreds of years, the professions have had this vision; they have looked forward and have devoted much effort to the training of strong young generations. They have built great schools, properly supervised and endowed, and have created a marvelous esprit-de-corps as a result. This is a phase of activity of which the business world is just becoming conscious.

Of course, business and industry prepare for the future in certain directions. They carry fire and liability insurance; they set up funds and reserves against depreciation, bad debts, and many other contingencies; and constantly plan for material and physical expansion. A striking example of preparation for the future in material and physical matters may be found in the studies of population and community development which the public service industries have made the basis of their plans for extensions.

American Industry is Neglecting the Training of Skilled Mechanics

However, in spite of the fact that the entire business and industrial structure depends upon strong human organizations of mechanics and expert technicians, very little is being done in American industry to develop such men. In fact, so little is being done in this direction that any enterprise for the development of the human factor in industry still has news value. When a corporation installs an apprentice training program, this fact is of sufficient interest to warrant a certain amount of space in technical and trade publications.

Imagine what the editor of a business paper would think if he were to receive a story to the effect that a certain new manufacturing corporation contemplated an accounting department as a part of its organization. The accounting department is absolutely taken for granted. Why is it that we do not take a training or apprenticeship department in every enterprise absolutely for granted?

Although the business world on the whole pays little attention to the problems of industrial train-

ing, there has been considerable development of apprenticeship in a number of industries, including the metal trades industry. However, such apprentice training enterprises have usually been instituted largely as a result of an immediate difficulty, and not because of a broad understanding and appreciation of the personnel problem in industry. A manufacturer who has tried in vain for many years to engage sufficient mechanics of the right kind for his business will train apprentices out of sheer necessity, and sometimes considerably against his will. The employer who has had no success in recruiting his supervisory forces and finds himself shorthanded in foremen, inspectors, supervisors, and technicians, begins to realize that he must develop this class of help from within his organization and installs an apprentice training program.

We have seldom heard of a manufacturer who has established apprenticeship or other forms of industrial training for the solution of the broad problems of the human factor in industry at a time when he did not himself happen to feel the need for trained men. This would be acting from a real professional motive. Such an attitude is not usually found among employers. Sometimes business men have acquired broader attitudes toward the human factor in industry after they have established an apprentice training program, but seldom has a program been established as a result of that attitude.

American industry, considered as a whole, has failed to assume the responsibility of industrial training; nevertheless, there are many cases of successful apprentice courses—more than enough to prove that apprentice training can be made a success. Some of the oldest and best known firms in the machine-building industry have built their entire organization upon an apprentice training program. A number of plants depend exclusively upon apprentice graduates for their supply of skilled mechanics. One large corporation has engaged no foreman from the outside for more than ten years, but has promoted men trained within its own organization. Those who have had the most experience with modern methods of training young men to become skilled mechanics assert that apprenticeship systems can be made a success.

It is Time for the Machinery Industry to Start Training Young Men Systematically

I am not particularly concerned whether or not the metal trades industry will ever be looked upon as a profession. However, I am very much concerned that the industry should adopt the methods and attitudes of the profession regarding the development of a strong human organization. It is time for the machinery building industry to develop a little foresight, and a little pride in the industry and in the men engaged in it. It is time for the industry as a whole, and all units that comprise it, to take steps to train men who will be the backbone of the industry in years to come and who will maintain the standards that have been set up, and improve upon them. A general activity of this kind would not only be of inestimable benefit to the industry, but also a great credit to it.

Business and industry are different from the professions in that the professions as a rule concern themselves only with the character of their own members, while business and industry must concern themselves not only with the character of the employers and leaders, but also with the character of the mechanics and working forces in general. High caliber business men can accomplish little unless their employes are also of high caliber. Neither employes nor employers can effectively maintain their high character alone.

It is time for the industry to provide in the field of personnel the same preparation and safeguards that have been provided in the material phase by insurance, reserves, and sinking funds.

Industry as a Whole will Gain if Manned by Intelligent, Highly Skilled Men

Business leaders must establish apprentice training for skilled men not merely to supply the required number of mechanics but particularly to improve the standard of the personnel in the industry. Surely, it is far better for industry in every way if shops and factories are manned by intelligent, highly skilled men rather than by distinctly inferior men, without principle, skill or morale—restless, dissatisfied, and unstable. Apprenticeship can accomplish the difference. Training will change the entire character of industry.

Of course, in order to satisfy these requirements, the apprentice training program must be a sincere effort. Any attempt to carry on the work for any other than the obvious motives will be detected—any attempt at exploitation will fail. There is perhaps no line of activity in which it is more futile to try to "fool the public." Every attempt that has ever been made to provide cheap labor in the guise of apprenticeship has probably failed. Apprenticeship must be just exactly what it pretends to be—it must be an actual training program. The apprentice must feel conscious of progress as he continues his work, and he must be a skilled man when the course is completed.

Painstaking Effort is Required in Planning Apprentice Training

In arranging the apprentice course and in carrying it out, a careful study must be made of the trade and of trade requirements. The best foundation for a thorough program is the answer made to the question: What is expected of a skilled mechanic? Or a still better basis is an organized set of plans to overcome the deficiencies discovered in mechanics in one's own plant.

Have you ever reprimanded a mechanic because his cutting tool was not properly set up? The apprentice course must include sufficient instruction in this department of work. Have you ever been disappointed in a man who called himself an all-around mechanic and hesitated to accept a planer job that was a little more difficult than the average? The apprentice training course must include ade-

quate training in the operation of all important machines. Has the progress of work in your plant ever been held up by a mechanic who required constant assistance in the reading of a blueprint? The difficulty can be corrected by providing proper instruction in the apprentice course.

Do the foremen in your plant spend too much time in making simple calculations for the men in their departments? Classes in shop mathematics as a part of apprentice training are a direct antidote. Do your men always oil and clean machinery properly? If not, it would appear that directions for the proper care and maintenance of machinery should become a part of a complete apprenticeship. The apprentice course should be planned to turn out the ideal mechanic for the metal trades industry—or one who is as near the ideal as can be achieved.

If you feel that skill on the lathe, milling machine, planer and shaper, boring mill, drill press, grinder, and turret lathe are essential to a good mechanic, then your apprentice course must include sufficient experience on these various machines; and the time spent by the apprentice on each machine should be in proportion to its relative importance. In a similar manner, the theoretical courses, the studies in mathematics and mechanics, should be arranged according to actual trade requirements.

There are Many Companies that Maintain Successful Apprentice Courses

While American industry on the whole ignores the responsibility of industrial training, there are many cases of successful apprenticeship—more than enough to prove that apprentice training is feasible, provided it receives the proper attention. The oldest and best known firms in the machine building industry have trained apprentices successfully for many years. Many of them have frankly built their entire organization upon an apprentice training program. American railroads have been distinctly successful in apprentice training for their shop departments.

The Community Apprentice Training Method, Usually Known as the Milwaukee Plan

Community apprenticeship enterprises have made progress in various manufacturing districts. In the Milwaukee district, for instance, thirty-three members of the National Metal Trades Association employ 1086 apprentices, in a total employment of 20,195. A number of the member plants depend exclusively upon apprentice graduates for their supply of skilled mechanics. One organization which operates a number of foundries, reports that for several years no molders other than graduates of their own apprentice training program have been engaged. A very large corporation has engaged no foremen, for more than ten years, other than those who have been developed within its own organizations, except in cases where smaller plants were absorbed.

The training work in the district is well coordinated under the direction of a general apprenticeship committee which has standardized the apprentice courses in the various shops as far as wages and hours of work to be completed in the apprentice courses are concerned, and to a considerable extent has influenced the formation of work schedules, so that the training provided in the various shops shall be approximately the same. Also, under the influence of the committee, the methods of supervision in the different shops have been standardized and well established.

There are many manufacturers in the machine-building industry who are eager to start work on a plan for the training of young men to become skilled mechanics, but they hesitate to proceed because of their lack of experience. In order to assist manufacturers who wish to start apprentice training courses, the Committee on Industrial Education of the National Metal Trades Association, Peoples Gas Building, Chicago, Ill., has made arrangements for the preparation of courses of instruction for apprentices, which may be applied to the apprentice training departments of individual manufacturers. These courses pertain both to practical shop training and to classroom instruction. Members of the educational staff of the Association are also available to assist manufacturers in starting training courses.

The Effect of Organized Apprentice Training on the Community

As a result of the combined efforts of the various metal trades employers in the district, apprentice training has been recognized by the community as a legitimate educational activity for young men and a proper preparation for a career in the industry of the city. The earnest and systematic efforts that the manufacturers have devoted to this activity have given it coherence, dignity, and stability, which could not help but force the people in the community to take it seriously.

A good example of this respectful attitude is the approval that high school principals have given to the apprenticeship work in the industries. Educators in general are justly skeptical of all new movements that aim to influence young people in those years that precede maturity. They cannot accept and approve such influences until they have carefully investigated them and satisfied themselves that they are beneficial. Representatives of industry have been asked to explain the apprenticeship system to the students of three Milwaukee high schools and three suburban high schools, and in one of the high schools apprentices have been definitely recruited from the senior class. In a number of cases, high schools have requested permission for classes to visit industrial plants under the direction of the apprentice departments in those plants.

Correct Methods are Necessary if an Apprentice System is to Succeed

In apprentice training, as in all other activities, there are correct practices and incorrect practices. The correct practices will succeed, the others will not. There are many employers in the machine building industry who are eager to start work in

the training of young men, but hesitate to proceed because of lack of experience. In order to overcome this objection on the part of its members, the officers and the Committee on Industrial Education of the National Metal Trades Association have made arrangements for the preparation of courses of instruction for apprentices which may be applied to the apprentice training problems of the individual manufacturer.

Within the last two years, the committee has also issued a complete manual and text for foremanship conferences which have been successfully installed in many of the member plants. Under the plan evolved by the committee, members of the educational staff of the Association hold classes for the training of conference leaders in the various communities, and these leaders then establish conferences in their respective plants and use the texts provided by the Association.

Much the same method will be used in the field of apprenticeship. The work has already begun and texts are being prepared both for practical shop instruction and for instruction in related theory. Members of the educational staff are available to assist members in getting their apprentice training programs under way, and little difficulty should be encountered afterward if proper use is made of the apprenticeship text material.

In this way, the committee believes that there may be built up a fuller realization of the importance of training men for the industry and a more general appreciation of the desirability of what may well be called the professional attitude toward the development of a strong human organization.

Accurate Cost Systems are Needed

By ERNEST F. DuBRUL, General Manager, National Machine Tool Builders' Association

In the editorial on page 602 of April MACHINERY, "An Accurate Cost System Promotes Stability in Industry," an instance is given of a manufacturer who stated that it was valuable to know one's costs accurately only if every other manufacturer in the field also knew his. He maintained that so long as some competitors sold below cost, it was not of much value to the others to know their costs, because they had to set their selling price on a competitive basis, irrespective of costs.

It is surprising to find how frequently this fallacious view is held by manufacturers. Too many say, "Competition sets the price—what's the use of knowing costs?" Managers often associate the idea that "competition sets the price" with the idea that they "have to take an order regardless of price." Generally, it is the man who complains most about competition setting a low price who is most willing to go a little lower to get the order. He is so intent on volume that he loses sight of the real function of a manager, which is to make the business pay.

Even if one has foolish competitors who do not know their costs, it is necessary to know one's own costs. Only that knowledge can stimulate one either to reduce the costs or to go into some other line of business where there are not so many foolish competitors and in which a reasonable profit can be earned.

Competitors who are ignorant of costs do not long set the prices for sensible competitors. The competitor who sets unprofitable prices on account of lack of knowledge of costs cannot possibly get all the business there is to be had. Those who know their costs can, and generally do, refuse to take business on an unprofitable basis, and they get business at a profit nevertheless. Because one man insists on going blindly into bankruptcy is no reason why all his competitors should deliberately do the same. A man who thinks that it is of no value to know his own costs, because he has a foolish competitor, gives evidence of his own lack of business capacity.

CENTENNIAL TO COMMEMORATE INVENTION OF PLATFORM SCALE

To commemorate the invention of the modern platform scale, Fairbanks, Morse & Co., of Chicago, Ill., will celebrate, in St. Johnsbury, Vt., on July 4, 5, and 6, the one-hundredth anniversary of the invention of the modern platform scale. This invention was made in 1830 by Thaddeus Fairbanks. Former President Coolidge will be a guest of honor at the celebration. Mr. Coolidge was at one time a student at the St. Johnsbury Academy, which in the early days was supported by Thaddeus Fairbanks. The main feature of the celebration will be a historical pageant depicting the progress of modern weighing equipment during the last century. There will also be an exhibition of the original patent models of scales invented by Fairbanks, which have been borrowed for the occasion from the Patent Office, and which form an extremely interesting collection of early patent models.

* * *

The Merchandise Mart of Chicago, the largest building in the world in total floor area, has just been completed. The object of the building is to provide facilities for manufacturers and dealers for permanent merchandise displays, sales quarters, and offices. The building has a total floor space of over ninety acres. Its greatest length is 724 feet, and its greatest width, 577 feet. The main structure is eighteen stories high with a six-story tower. It will furnish a place of work for 30,000 people.

Diamond-boring Applied to Production Work

Fixtures Designed for Holding Small Parts for Diamond-boring Operations on a Two-spindle Vertical Boring Machine

FOUR examples of diamond-boring operations on small parts, performed on a Coulter boring machine, built by the Automatic Machine Co., Bridgeport, Conn., are illustrated and described in this article. Although the parts are entirely different in shape, similar means are employed to hold them securely in place during the boring operations. In each case, automatic clamps are used, which greatly reduce the so-called "idle" or loading time.

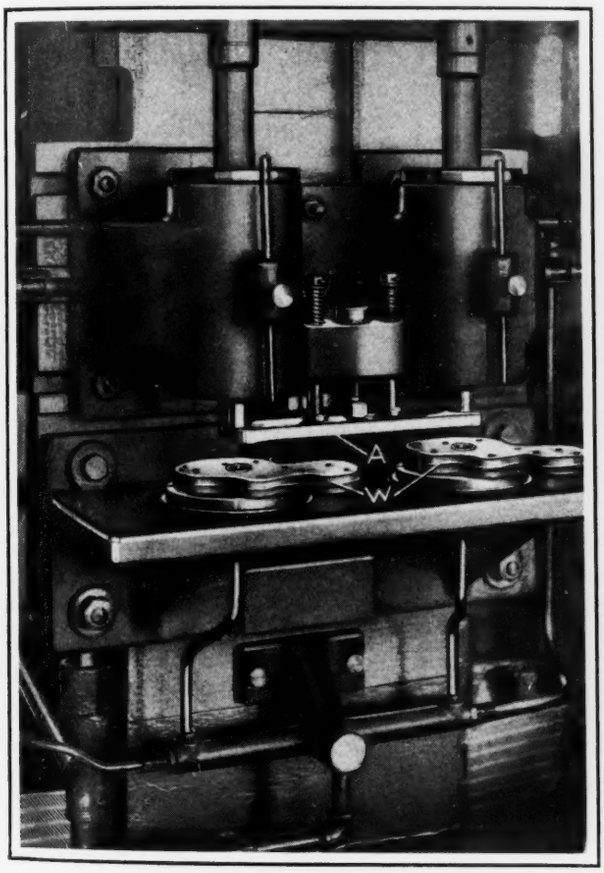


Fig. 1. Refrigerator Parts in Position Ready for Clamping and Boring with Diamond Tools

In Fig. 1 two guide plates *W* for electrical refrigerators are shown in position on the work-holding fixture ready to be clamped in place. The operation performed on these parts consists of finish-boring a bronze bushing to a diameter of 0.750 inch for a length of 0.750 inch. This work is required to be held within limits of 0.0002 inch. Just before the boring tool comes into contact with the work, the plate *A* descends and securely clamps the work in place.

The spindle speed employed for this boring operation is 4000 revolutions per minute. The feed is 0.0007 inch per revolution and the depth of chip 0.005 inch. Approximately 30 seconds is required to complete the machine cycle which finish-bores the bushings in the two pieces simultaneously. The chucking time for the two pieces is 5 seconds.

Fixture with Adapter for Holding Irregular Shaped Parts

In Fig. 2 is shown a fixture designed for locating and holding parts of irregular shape. In this particular case, the fixture is set up for holding a pump

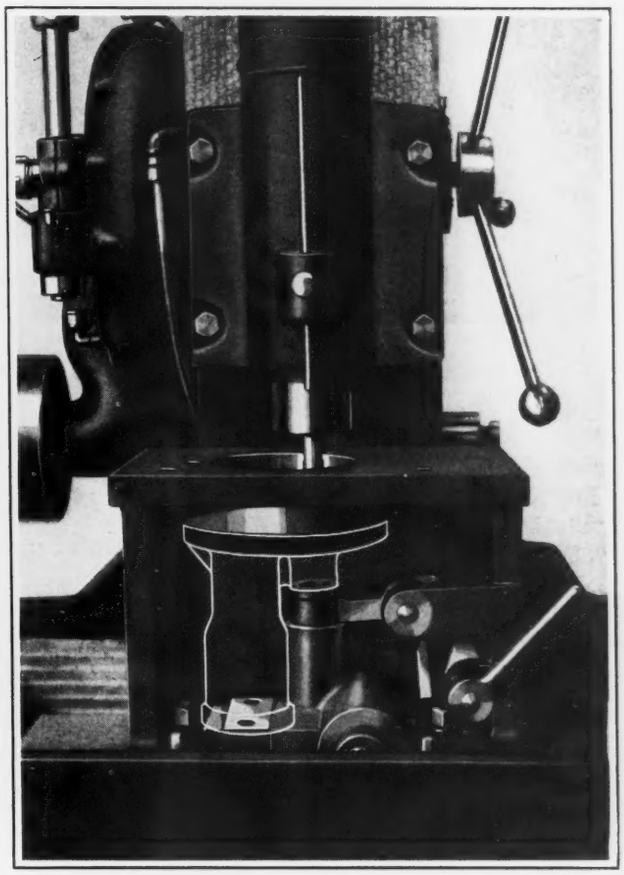


Fig. 2. Fixture Designed for Holding Irregularly Shaped Parts for Boring Operations

body while boring a 3/4-inch hole in a bronze bushing. The tolerance on the diameter of this hole is 0.0005 inch. The position of the pump body in the fixture is indicated by the white lines. The various parts of the fixture itself are shown in Fig. 7. This illustration shows the position of the floating clamp when holding the pump body securely in place during the boring operation.

The adapter and the auxiliary support can be changed quickly to accommodate different parts of irregular shape. The diamond tool boring-bar used with this fixture is of the adjustable type and can be set to hold the work to close limits of accuracy. The 3/4-inch hole in the bronze bushing is bored

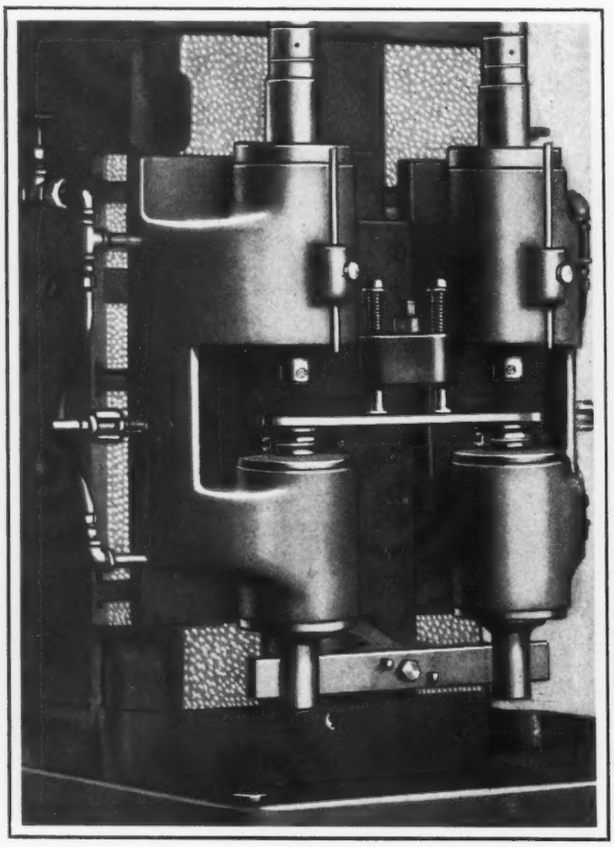


Fig. 3. Equipment Used in Boring Bronze Bushings in Valve Rocker Arms

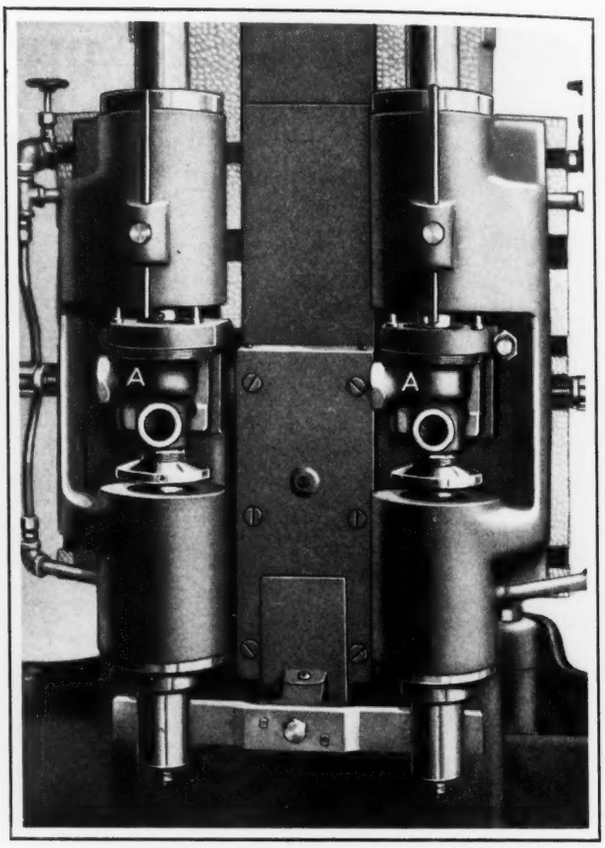


Fig. 4. Fixture Used in Finish-boring Holes in Brass Valve Bodies

the full length of the bushing, which is 1 5/16 inches.

For this boring operation, a spindle speed of 4000 revolutions per minute is employed, with a feed of 0.0006 inch per revolution. The depth of cut or the thickness of the chip taken by the diamond tool is 0.010 inch. The boring time is 34 seconds per piece, and the time required for chucking is 15 seconds.

One-piece Fixtures with Locating Pilots for Boring Valve Rocker-arm Bushings

The bronze bushings in valve rocker arms are bored to a diameter of 1.4681 inches for a length of 1 inch at the rate of two pieces in 30 seconds by the equipment shown in Fig. 3. The chucking time for this work is 10 seconds for two pieces. In this case, the work is held within limits of accuracy of 0.0002

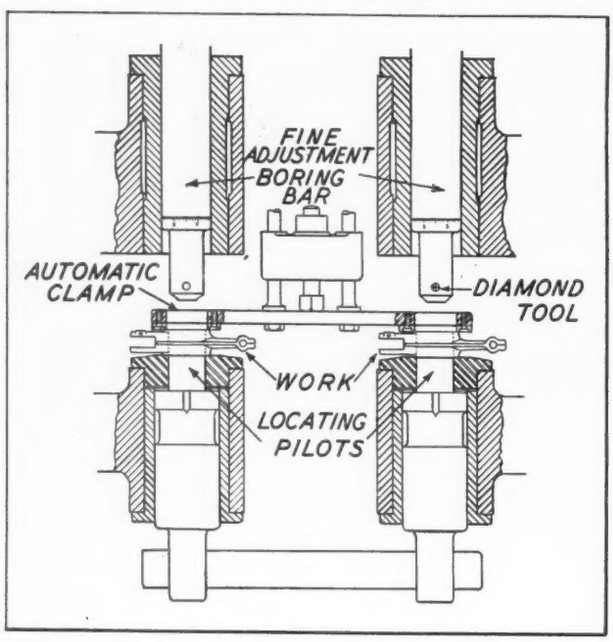


Fig. 5. View Showing Construction of Fixtures Illustrated in Fig. 3

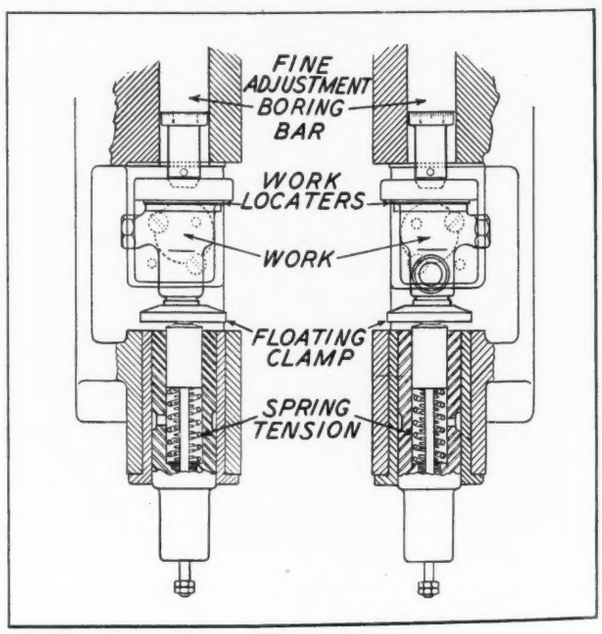


Fig. 6. Cross-section of Clamping and Holding Fixtures Shown in Fig. 4

inch. The feed employed is 0.0014 inch per revolution and the depth of the chip taken by the tool is 0.005 inch.

The one-piece fixtures constructed as shown in Fig. 5 permit quick, accurate chucking, automatic clamping, and a quick release of the finished work. The locating pilots on which the work is placed recede after the automatic clamp has secured the

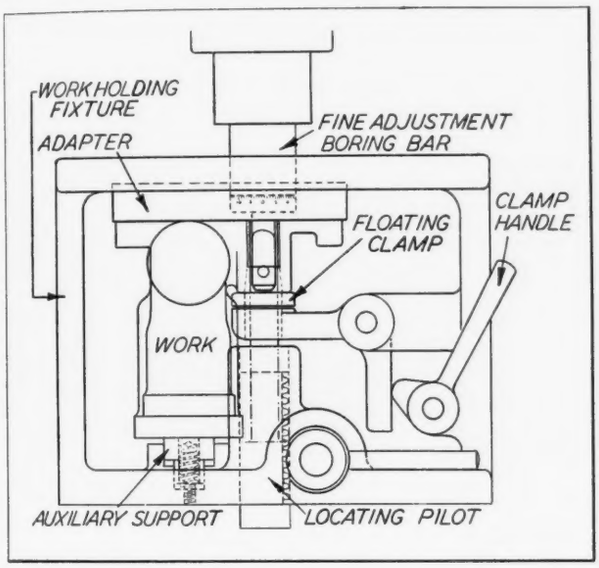


Fig. 7. View Showing Construction of Fixture Illustrated in Fig. 2

work in place, allowing the diamond tools to perform the boring operation. The fine adjustment feature of the boring-bar indicated in this illustration is also provided on the boring-bars of the machine shown in Fig. 1.

Equipment for Boring Valve Bodies

In Fig. 4 are shown two brass valve bodies *A* mounted in automatic fixtures ready for the boring operation which finishes the hole to a diameter of 1.4375 inches within limits of accuracy of 0.0002 inch. The length of the hole or bore is 1 11/16 inches. The spindles of the diamond boring tools run at a speed of 4000 revolutions per minute. The feed is 0.0015 inch and the thickness of chip 0.005 inch. The machining cycle is completed in 30 seconds, and the time required for chucking is 5 seconds per piece.

The construction of the work-holding fixture is shown in Fig. 6. The lower floating members which support the work are backed up by tension springs which are compressed when the work-locating members are forced down on the top surfaces of the valve bodies. The lubricant for the tools, in this case, is forced up from the bottom of the clamp under high pressure. This serves to keep the chips in suspension and prevents the finished surfaces from being scratched.

The examples selected illustrate the broad application of the diamond-boring process.

FIFTIETH ANNIVERSARY OF CLEVELAND ENGINEERING SOCIETY

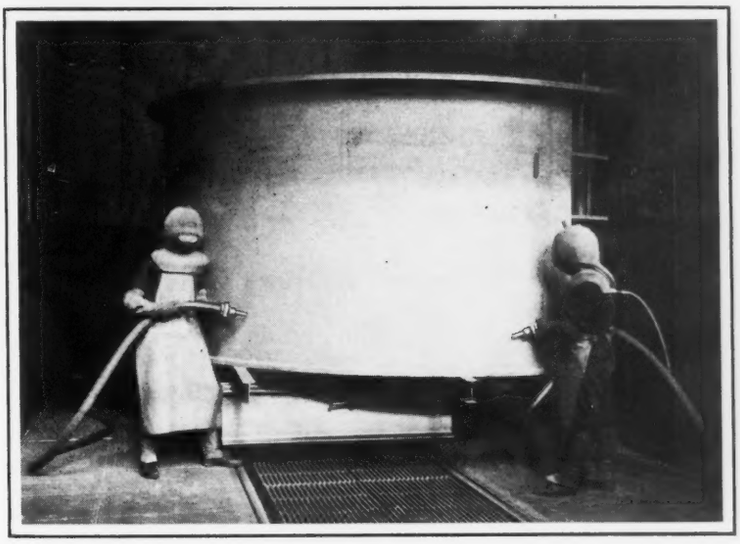
An interesting publication entitled "The Golden Anniversary Book of the Cleveland Engineering Society" has been published to commemorate the fiftieth anniversary of the Society, celebrated this year. The book contains a review of the principal lines of industry in the Cleveland district and the outstanding contributions made by these industries toward the progress of engineering. The industries covered are the automotive, building, chemical, electrical, foundry, mechanical, paint and varnish, rubber, steel, and transportation fields. In addition, there are chapters on the facilities for higher technical education in Cleveland, a general review of Cleveland's industries, and of the opportunities for engineers. A brief history of the Cleveland Engineering Society forms the concluding chapter of the book.

* * *

CLEANING CASTINGS BY MODERN MEANS

The men in the accompanying illustration are not deep-sea divers, nor is the equipment they wear intended for chemical warfare. They are peace-loving General Electric workmen dressed in the garb that has been found most suitable and convenient when cleaning castings by the modern method of using very fine steel shot in a manner similar to that used in sand-blasting. The equipment used sprays steel shot at a rate of 100 pounds per minute on the surface of the casting.

The workman wears a helmet partly to protect his head from the rebounding steel shot, but mainly to permit him to breathe clean air. Washed air is



Cleaning Large Steel Casting by Means of Fine Steel Shot Applied as in Sand-blasting

pumped to him the same as to deep-sea divers, so that he works in absolute safety and avoids the dust due to the cleaning operation. This dust is carried off together with the fired shot, separated, and the shot returned to the gun to be used over and over again until it is worn to a dust.

Important Points on Power Press Die Design

In a paper by M. A. Lynch, read before the Rugby Engineering Society, some information of interest and value to diemakers and designers was given. Some of the interesting points are presented in the following:

Tool clearance may be determined as follows: (a) The size of a blank is governed by the size of the die through which it passes. (b) The size of a hole is governed by the size of the punch which passes through it. Thus, if a 2-inch diameter blank is required from a certain stock, the punch might be 1.996 inches in diameter, and the die 2 inches in diameter, but if a 2-inch diameter hole had to be pierced in the same stock, the punch would be 2 inches in diameter, and the die 2.004 inches in diameter.

Method of Providing Die Relief

Dies should be relieved for two reasons: (a) To provide rake for the cutting edges. (b) To facilitate the removal of the blanks or piercings. To provide rake, dies should be relieved right up to their cutting edges, whenever possible. A relief of 3 degrees included angle will allow of a die face being ground down 3/32 inch before the die opening is increased 0.005 inch in diameter. However, it is common practice, where high accuracy is required, to provide dies with parallel cutting faces for 3/32 to 1/4 inch, according to the thickness of the stock and the estimated life of the dies. In any case, relief is required beyond the parallel portion; otherwise, the blanks or piercings will pile up and become firmly wedged in the die.

Allowance on Blanks to be Shaved

Stock Thickness, Inch	Soft Steel, Inch	Medium Hard Steel, Inch	Soft Brass, Inch	Medium Hard Brass, Inch
0.047	0.0025	0.003	0.005	0.006
0.063	0.003	0.004	0.0055	0.007
0.078	0.0035	0.005	0.006	0.008
0.094	0.004	0.006	0.0065	0.009
0.109	0.005	0.007	0.007	0.010
0.125	0.006	0.008	0.0075	0.011

Machinery

Over-size Allowance for Shaving after Blanking

Shaving tools are used on work where very high accuracy and smooth clean edges on the work are required, as, for example, on watch and clock wheels. The comparatively rough and uneven edges produced by blanking or piercing are cleaned up by removing a few thousandths of an inch around the profile. The allowance made for shaving—that is, the amount by which the blank is made over-size—varies with the metal, its hardness and thickness. The closer the grain of the metal, the smaller should be the allowance. The accompanying table gives the amounts for general work. The shaving allowance is to be added on each side of the blank.

Maximum reductions, that is, the difference between the diameter of the shell drawn and the diameter of the blank or unfinished shell from which it is drawn, are as follows:

For double-action tools, 40 per cent reduction for first operations; 30 per cent reduction for second operations; and 20 per cent reduction for successive operations.

For single-action tools, 30 per cent reduction for first operations; 20 per cent reduction for second operations; and 10 per cent reduction for successive operations.

The drawing radius—that is, the radius of the corner around which the metal flows during reduction—should be five to ten times the thickness of the stock used.

Problems in Taper Drawing

The production of a tapered cup presents more difficulty, perhaps, than any other class of drawing work, and to form such cups free from creases necessitates very carefully designed tools, together with a certain amount of practical trial and error experimenting, before success is achieved. The greatest difficulties arise where the stock is thin, as thin metal tends to crease badly. The greater the amount of taper per unit length, the greater will be the difficulty in producing a satisfactory article. This is because in making a taper, pure drawing does not occur. The action resembles forming, combined with drawing. Thus the metal cannot be effectively held under pressure as in an ordinary drawing operation.

In taper drawing tools, provision should invariably be made for ejecting the work from both the punch and die, as it is as likely to remain on one as in the other. As a general rule, the tools should be inverted. By this means, the work can be centered conveniently on a sliding ring. To produce a tapered cup, lid, or similar part, it is sometimes advisable to approximate the required shape by successive reductions in steps and then remove the ridges in a spinning operation; but this is not commonly accepted practice in the industry.

Distance between Die Openings

No hard-and-fast rule can be laid down as to the thinnest allowable wall between two die openings, for this is governed by several factors, the chief being: (a) thickness of stock; (b) shape of openings; (c) material to be cut; and (d) state of die (if hard, tempered, etc.).

For general purposes, a minimum distance of 1/8 inch has become almost proverbial, but when working on thin stock, this may be reduced to as little as 1/32 inch. In the case of a series of dies for piercing 0.022 inch copper, each of the dies had a minimum distance between openings of 1/32 inch, and they all sustained many thousands of strokes without failing. The success of these dies was due

in no small measure, perhaps, to the fact that as two adjacent punches were of slightly different lengths, the shorter punches, on entering the dies, were virtually surrounded by a complete thick wall of metal.

In laying out tools for working on intermittently fed stock, the feed should be arranged so that the minimum distance between successive blanks is not less than the stock thickness; also, the bridge between the blanks and the edge of the stock should not be less than this amount.

* * *

MUSEUM WANTS OLD MACHINE TOOLS

An exhibit that will picture the development of machine tools from the beginning of the last century up to the present time will be held this fall in New York City by the Museum of Peaceful Arts. This museum was established through a bequest in the will of Henry R. Towne to serve as an instrument of popular industrial education. The museum will shortly move into larger quarters in New York City, and the machine tool exhibit will be held to commemorate this expansion.

To complete the exhibit, the museum requires a number of machines, and is requesting men engaged in the industries who have in their possession any of the machines listed below, or who may know of the possible whereabouts of such machines, to communicate with Roberts Everett Associates, 225 W. 34th St., New York City, who are assembling the special exhibit on behalf of the Museum of Peaceful Arts.

Any machine tools or parts of machine tools built before 1820 are wanted. In addition, the museum would like to obtain lathes, bevel gear cutters, screw machines, and index milling machines built between 1820 and 1850; profiling machines, linear dividing engines, cylinder grinders, universal grinding machines, and spiral gear planers built between 1850 and 1880; and vertical boring and turning mills, gear shapers, Rogers Bond comparators, multiple-spindle machines, planer type milling machines, broaching machines, bevel gear generating machines, internal grinders, and hobbing machines built between 1880 and 1914. There are doubtless many old machines in the possession of machinery builders in different parts of the country that would be of great value as exhibits.

ROLLING 2400 FEET OF STRIP STEEL A MINUTE

Strip steel is rolled so fast by the continuous rolling method at the Sharon Steel Hoop Co.'s plant at Sharon, Pa., that one end of the strip is in the shipping room before the other end is out of the furnace. The mill is one of the fastest strip rolling mills in this country, and incorporates many new methods and much improved equipment. It is entirely electric in its operation. The electrical equipment, furnished by the General Electric Co., aggregates 45,000 horsepower.

The strip is rolled at a maximum speed of 2400 feet per minute, or about 26 to 27 miles per hour. The steel enters the rolling mill in lengths of 30 feet and is rolled to a length of from 1500 to 1800 feet. The final thickness is reached in the space of a few seconds, the strip leaving the rolls white hot.

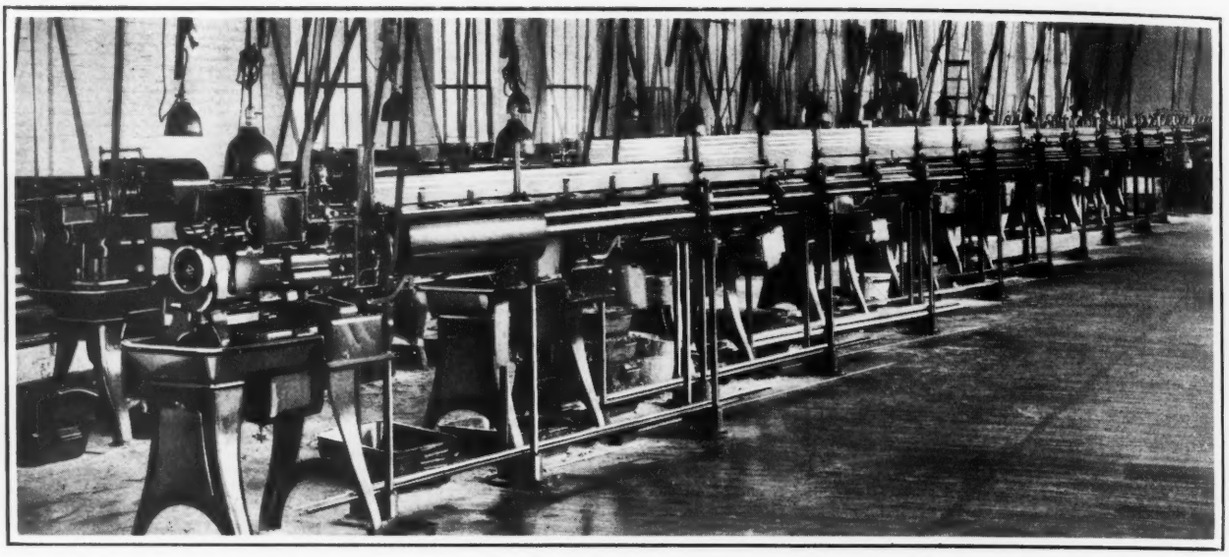
The So-called "Operating Pulpit," from which the Entire Operation of the Strip Rolling Mill is Controlled

One of the novelties in this plant is the use of a modified "public address" system with a microphone and loud speaker, by means of which the men on the rolling floor are able to give instructions concerning operations and speed changes to the operator in the control "pulpit." This method of communication was adopted to facilitate the high speed of operation, as it keeps the pulpit operator in constant and immediate audible contact with the work he controls. He can also see these operations through the glass sides of the pulpit, which is mounted in an elevated position overlooking the rolling floor.

The various products handled require a range of speeds varying from one-quarter to full speed. Throughout this wide range the speed relations of the twelve major rolling mill motors are held to within 0.1 per cent. This control is automatic and operates without the attention of the pulpit operator. The roughing mill motor is the largest used in the strip mill and is rated at 4500 horsepower. It is one of the largest motors used for this class of service in this country. It is 21 feet long, weighs 221,000 pounds, and has a rotating shaft 24 inches in diameter. It operates at speeds of from 150 to 450 revolutions per minute.

* * *

The exports of metal-working machinery from the United States in 1929 totalled $40,803,000—an increase of 18 per cent over the exports in 1928.



Automatic Screw Machine Developments

Recent Improvements in the Brown & Sharpe Automatic Screw Machines, Permitting Higher Speeds and Reduction in Idle Machine Time

WITHIN the last few years the rapidly growing demands for increased production of parts made from brass and other free-cutting materials, on automatic screw machines, have resulted in the introduction of a high-speed automatic screw machine with features permitting of more rapid indexing of the turret and feeding of the stock, as well as greatly increased spindle speeds, varying from 875 to 5000 revolutions per minute according to the capacity of the machine.

The high-speed automatic screw machines built by the Brown & Sharpe Mfg. Co., Providence, R. I., are available in three sizes — the No. 00 for the lighter class of work, with a maximum spindle

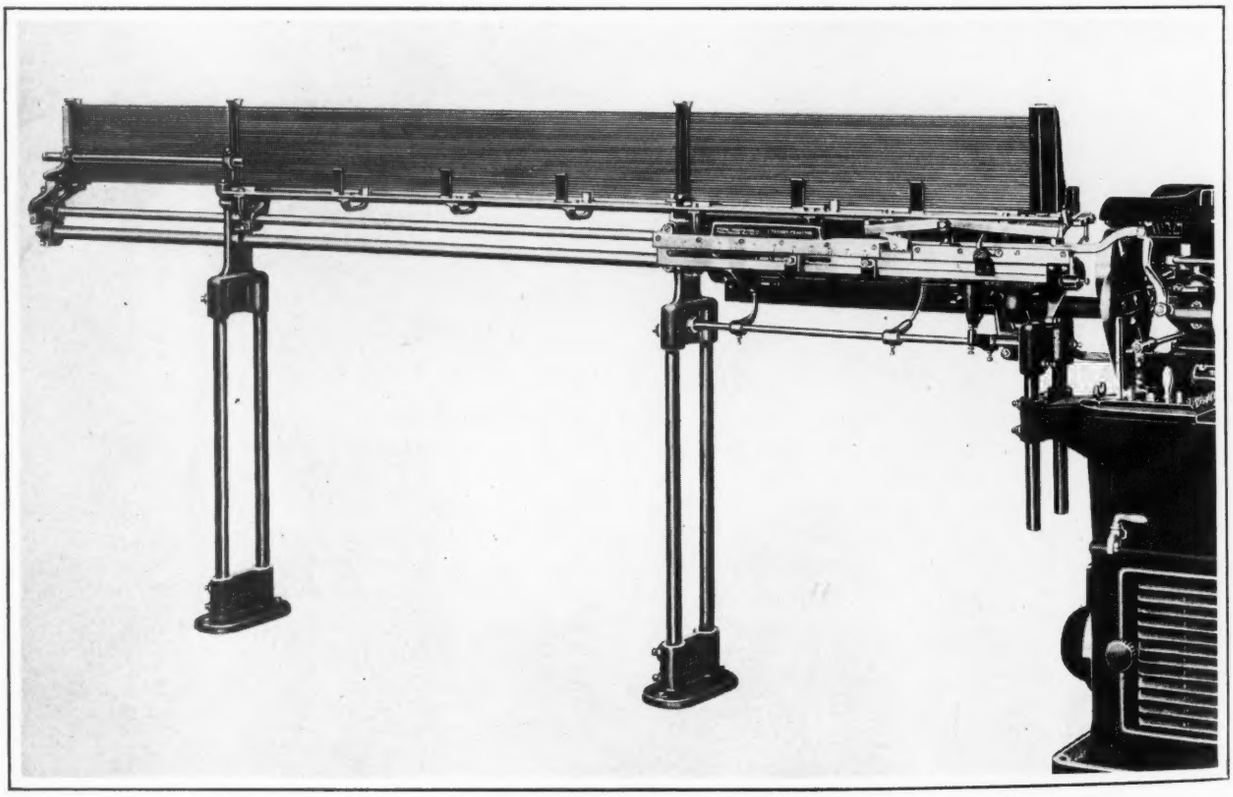


Fig. 1. Magazine from which Rods are Automatically Fed into the Screw Machine Spindle

speed of 5000 revolutions per minute; the No. 0 for a medium class of work, with a maximum spindle speed of 3600 revolutions per minute; and the No. 2 for the heavier class of work, with a maximum spindle speed of 2400 revolutions per minute.

Further increases in production are made possible by inceasing the speed of the driving shaft, which materially speeds up the movements of the turret slide, cross-slides, feeding mechanism, etc., and consequently reduces idle time. The changes incorporated in these automatic screw machines have resulted in a total increase in the net production, amounting, in some cases, to approximately 90 per cent.

Double indexing of the turret is another feature that has proved particularly advantageous, owing to the increased production obtainable on the high-speed machines, it being possible to rotate the turret, by indexing two successive positions at once, in the same time as would be required for a single indexing movement. On jobs requiring three turret positions, this feature permits a material saving in tools and time spent in adjustments; as only one set of tools is used, two positions are indexed at a time and the same rate of production is obtained as with two sets of tools and single indexing.

Stock Stop of the Swing Type

The use of a stock stop of the swing type and auxiliary tool-slides has also done much to effect reductions in idle time and serves to increase the tool capacity as well. A stop of this type is shown in Figs. 2 and 3. It is separate from the turret, and is operated by a cam after the finished work has been cut off, swinging into position just previous to the advance of the bar stock. It eliminates the use of the stock stop generally used in the turret, thus making available all six turret holes for the operating tools. When a piece of work requires but one turret operation in conjunction with the cross-slide tools, it is not necessary to index the turret at all, as the length of stock fed through the chuck can be controlled by the swing stop.

The vertical slide shown in Fig. 3 is an additional tool-slide, and on certain classes of work makes possible an appreciable increase in production. It was designed primarily to carry a cutting-off tool and to take the place of a swing tool or a cross-slide tool for cutting off, thereby leaving both cross-slides free for other operations. The vertical slide is also used for forming, knurling, thread-rolling, or any tool usually carried by the front or rear cross-slides.

The substitution of a vertical slide for the swing tool not only eliminates the long cam surface required to operate the tool arm, but also reduces the number of revolutions of the spindle required for tool clearance.

Restocking Screw Machines Automatically

Owing to the high spindle speeds employed on these automatic screw machines, much time would be lost in restocking the machines if they had to be stopped each time a new rod was inserted in the spindle. This loss of time would be particularly noticeable on work of more than ordinary length where the rods are consumed at a rapid rate.

With the magazine attachment shown in Fig. 1, however, new rods are fed through the spindle to the chuck as required, without the attention of the operator. When a rod has been used up, all moving members of the machine (except the spindle) are automatically stopped and a clutch is engaged to start the mechanism of the magazine in motion.

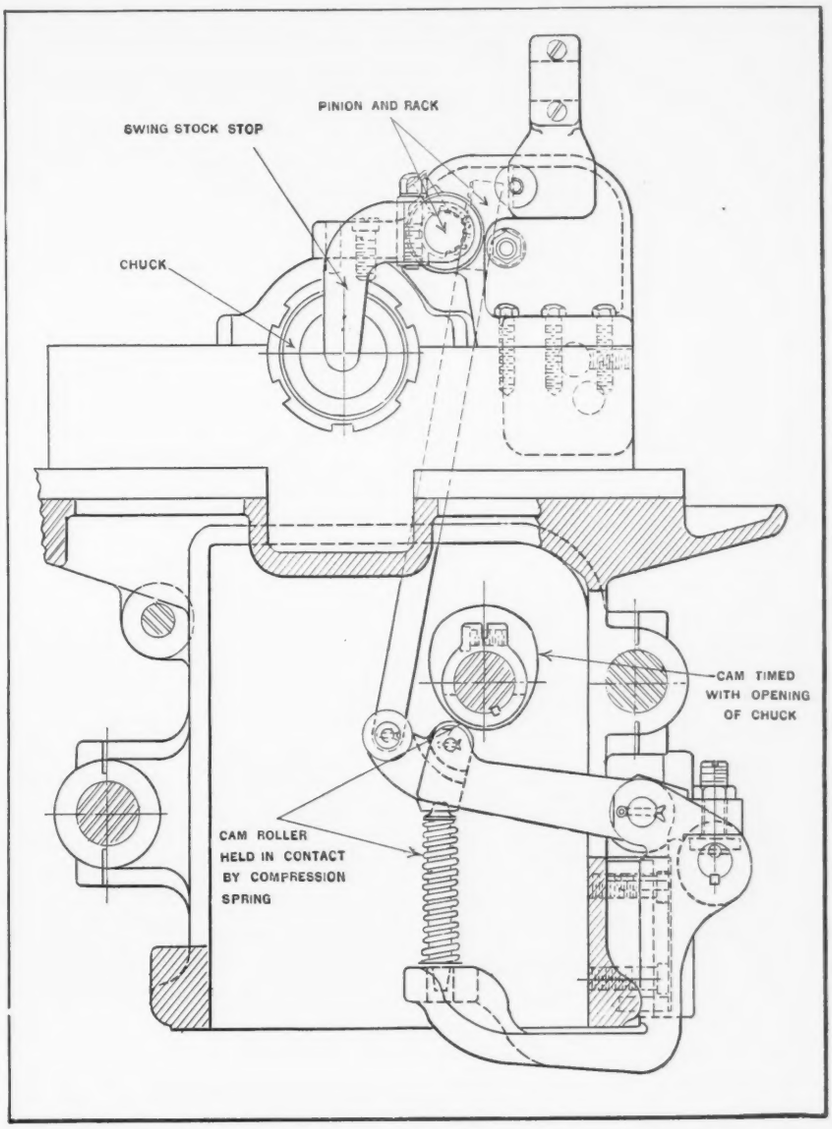


Fig. 2. Driving Mechanism for Swing Stop on Automatic Screw Machine

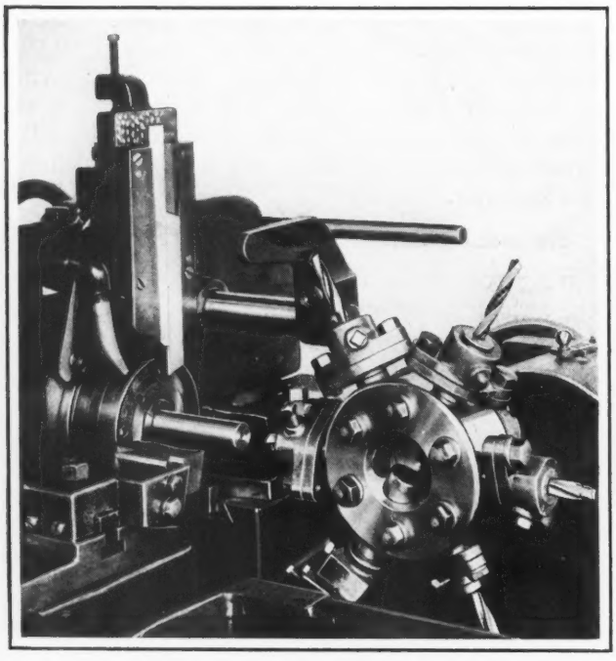


Fig. 3. Vertical Slide and Swing Stop of Automatic Screw Machine

As the magazine functions, a new rod is fed forward into the chuck, ejecting the remaining piece of the previous rod, and the machine is again automatically set in operation. The magazine can be restocked at any time without interfering with the operation of the machine or magazine, and does not require the services of a skilled operator. This arrangement accommodates various sizes of stock (round or hexagonal) up to the capacity of the machine with which it is being used, and is timed to correspond with the automatic functioning of the machine.

This development not only makes possible an appreciable reduction in idle machine time, but also reduces the number of man hours per machine by enabling one operator to attend to a greater number of machines than was possible formerly.

* * *

SIMPLE FORMULAS FOR DETERMINING THE WIDTH AT THE BOTTOM OF A SPLINE

By W. N. DELENK, Machine and Tool Engineer, National Acme Co., Windsor, Vt.

In making cutters for splining shafts, the width of the cutter on its outside diameter is not usually given and must be determined from the dimensions given on the shaft drawing. In the illustration, is shown a section of a spline shaft with the dimensions ordinarily given on the part drawing. Although there is more than one way of obtaining the required width X, the writer has found that the formulas to be given are very simple and easily applied. Having the values of the two sides R of the triangle at the right, the angle a can be determined by means of the following formula:

$$\text{Sin } 1/2a = \frac{A}{2R}$$

The angles c can then be obtained as follows:

$$c = \frac{180 - (d - a)}{2}$$

Then,

$$X = \frac{R \times \text{Sin } b}{\text{Sin } c}$$

To illustrate the use of these formulas, assume that $R = 0.53$ inch, $A = 0.312$ inch, and the center angle d between each successive tooth is 60 degrees. Then

$$\text{Sin } 1/2a = \frac{0.312}{1.06} = 0.29434$$

$$1/2a = 17 \text{ degrees } 7 \text{ minutes}$$

$$a = 34 \text{ degrees } 14 \text{ minutes}$$

$$b = 60 \text{ degrees} - 34 \text{ degrees } 14 \text{ minutes}$$

$$= 25 \text{ degrees } 46 \text{ minutes}$$

$$c = \frac{180 \text{ degrees} - b}{2} = 77 \text{ degrees } 7 \text{ minutes}$$

$$X = \frac{0.53 \times 0.43471}{0.97483} = 0.236 \text{ inch}$$

* * *

AN EFFECTIVE REPLACEMENT POLICY

A New England machine tool builder makes it a rule to replace approximately 10 per cent of his shop equipment every year. This means that the machines in the shop are, on an average, less than ten years old. Of course, certain types of machines may give first-class service even when they are more than ten years old; on the other hand, some types are replaced sooner if better equipment is available on the market. In 1929, this machine tool builder exceeded the 10-per-cent rule and installed even more equipment than he would have if he had followed his usual formula closely; as a result, the shop is always up-to-date in equipment.

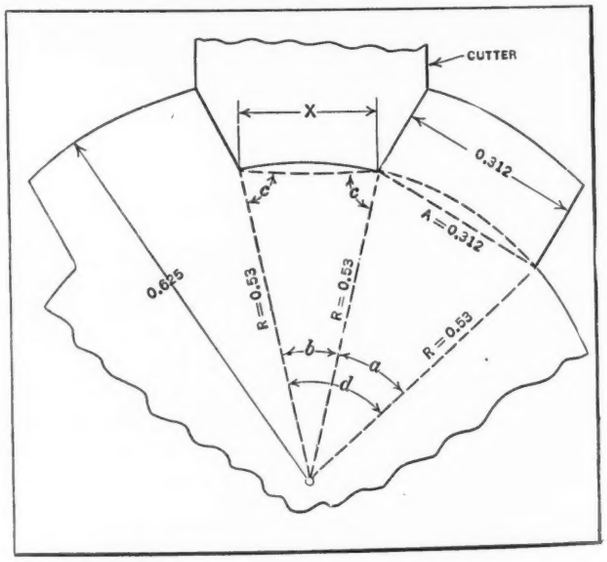


Diagram for Spline Cutter Calculations

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

CUTTING HARD GREASE INTO WAFERS FOR LOCOMOTIVE GREASE CUPS

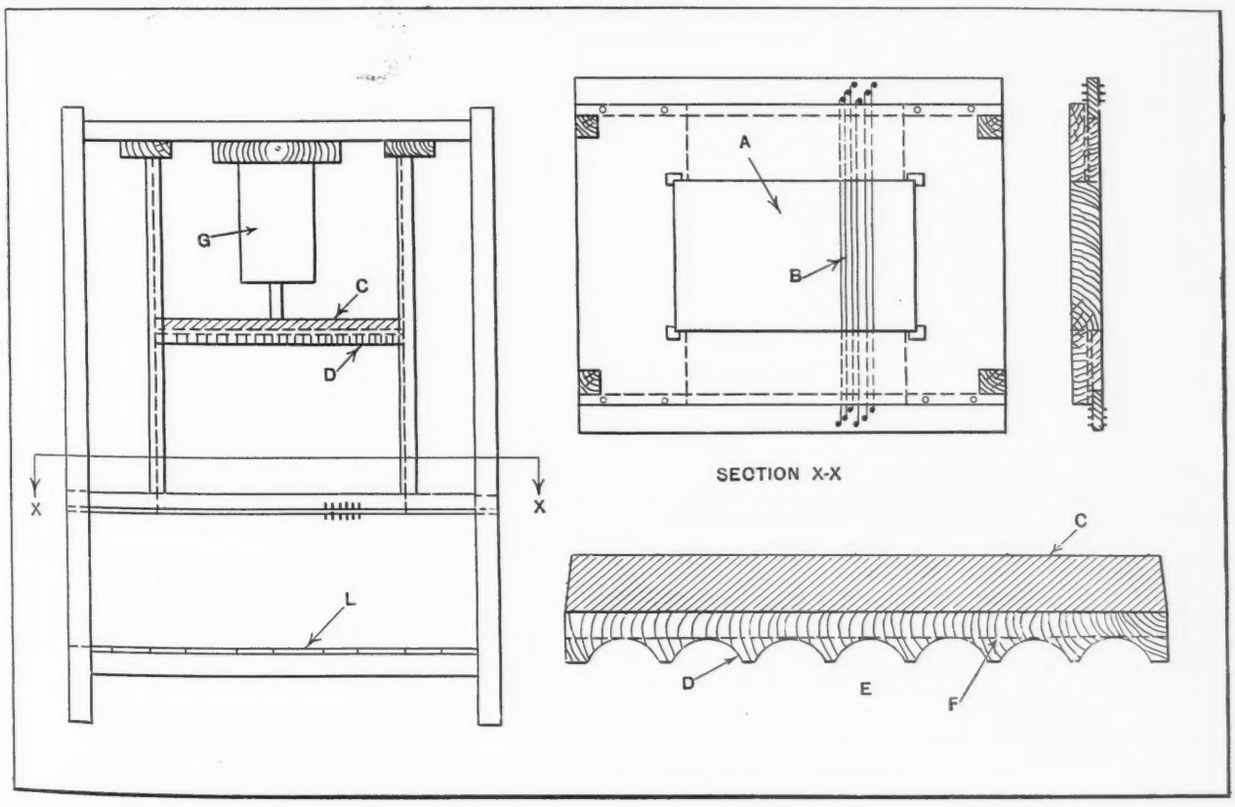
By DWIGHT LLOYD

One of the large railroads, which had decided to use hard grease for the bearings of locomotive driving rods, experienced some difficulty in cutting the grease into wafers or disks of the right size for the grease cups. The consistency of the grease was such that it could not be cut readily by means of knife blades. However, tests proved that the work could be done by thin wires, and a machine with wires arranged for cutting the grease rolls into wafers was built. A pneumatic forming machine was also made for converting the grease into rolls 1 1/2 inches in diameter by 28 inches in length. The wafer cutting machine, shown diagrammatically in the illustration, is designed to cut seven of these formed grease rolls into 469 wafers at one stroke.

The frame of the cutting machine is made of heavy oak timbers. Over an opening *A* in the machine table are stretched sixty-seven piano wires *B*. The seven grease rolls are placed on these wires, which are spaced to cut the rolls into wafers 3/8 inch in thickness. The grease is pressed downward past the wires by a pneumatically operated cast-iron platen *C* on the bottom of which are seven wood strips *D* shaped to conform with the contour of the rolls, as indicated in the enlarged view at *E*.

The wood strips *D* are slotted crosswise to permit the wires to pass entirely through the rolls of grease. The depth to which the slots are cut is indicated by the dotted line at *F*. Pressure is applied to the platen by means of an 8- by 12-inch air-brake cylinder *G*. This cylinder is operated from the regular shop air line, a valve being employed to reduce the pressure to 35 pounds per square inch.

The No. 14 piano wire used to cut the grease is secured to binding posts at each side of the table. The binding posts at the rear of the table are fixed, while those at the front can be turned to adjust the tension on the wire. These binding posts are made of 1/2-inch round machine steel, squared at the top to fit a wrench, turned to a diameter of 3/8 inch at the lower end, and threaded for a 3/8-inch nut. The piano wire is simply passed through a hole in the binding post and two or three turns made around the post to keep the wire from slipping. The binding posts are secured in place by tightening the nuts on their lower ends. A shelf *L* is provided as a support for the container which receives the wafers as they drop from the cutting wires.

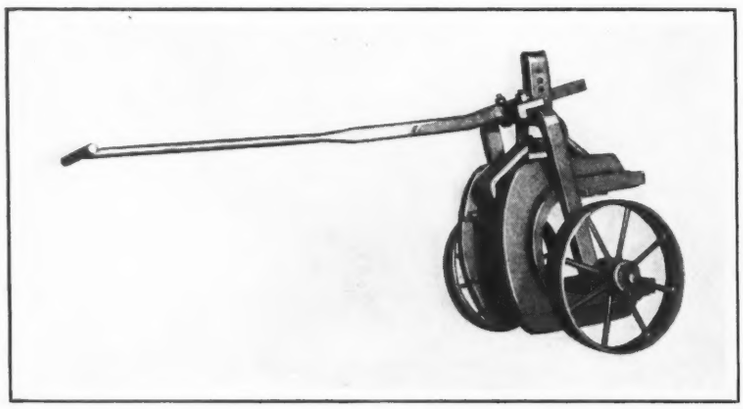


Diagrammatic Views of Grease Wafer Cutting Machine

SHOP TRUCK FOR LOCOMOTIVE DRIVING-BOXES

By H. H. HENSON, Foreman, Machine and Erecting Shop, Southern Railway Co.

In the accompanying illustration, is shown a two-wheel roller-bearing truck for moving locomotive driving-boxes about the shop. The truck is so designed that one man can handle the largest type driving-boxes with ease. The hooks that hold the work are made adjustable for height to accommodate the different sizes of boxes. This truck is particularly useful in shops not equipped with cranes.



Truck for Transporting Locomotive Driving-boxes about the Shop

MANDREL FOR MACHINING LOCOMOTIVE MAIN ROD BRASSES

The brass bearings generally used in the front ends of locomotive connecting-rods or main bearings, as they are generally termed, are made in two parts, known as the front half and the back half. These brasses are machined to fit the rod and are finished all over. The two halves are pressed into the rod and secured by a wedge and key bolt. This key bolt provides means for making adjustments to compensate for wear between the cross-head pin and the bore of the brasses.

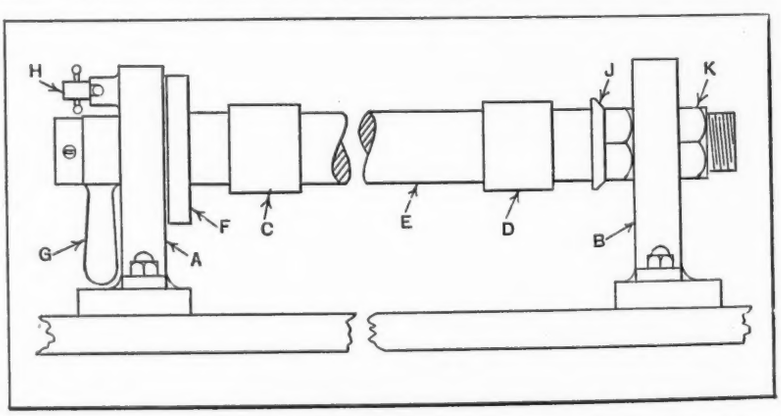
Various methods are used for machining the main rod brasses. With the method described in the following, which has been found very satisfactory, the brasses are first faced on the two edges and then "sweated" together in pairs. They are then faced on both sides to give the proper thickness. The brasses thus machined are placed on the mandrel *E* shown in the accompanying illustration and lined up with their sides parallel, and with their vertically positioned sides at right angles with the base.

The stop *C* on the mandrel is held permanently in place by a pin. From twelve to twenty-four brasses are usually placed on the mandrel at one time. Bearing *B* is removed to permit the brasses to be loaded on the mandrel. After they are all in place, stop *D* is put on the mandrel and the flanged nut *J* used to clamp the work. The bracket *B* is then replaced and the nut *K* screwed on the mandrel and tightened.

The handle *G*, which is threaded to fit the end of the mandrel, is used to clamp the faceplate *F* against the bracket *A*, while the locking pin *H* serves to prevent the mandrel from turning. Pin *H* also provides means for accurately indexing the brasses in order to machine the different sides. The brackets *A* and *B* are clamped to the bed of the machine. If a planer is used, two loaded mandrels can be mounted on the table and both heads on the cross-rail and both side heads used simultaneously. If a milling machine is employed, only one side of the brasses can be finished in one operation. In using the mandrel described, the best production time can be obtained with a planer type milling machine.

If the front ends of the main rods are not kept to standard dimensions, the brasses should be left over-size on one side. The unfinished side should be marked for identification. The brasses thus machined can be kept in stock, and when one is needed, it will only be necessary to fit one side to the rod and bore it out to fit the cross-head pin.

All the brasses used on the entire road can be machined at one shop, when mandrels of the type described are used. If the brasses are machined in large quantities, several extra mandrels should be available. These may be kept loaded and ready to be placed on the machine as soon as the mandrels with the finished brasses are removed. The mandrel shown in the illustration can be readily made up in the average railroad shop at small expense.



Indexing Type Mandrel Used to Hold Locomotive Main Rod Brasses while Planing or Milling the Sides

* * *

According to a statement issued by the National Automobile Chamber of Commerce, the annual ton-mileage handled by motor trucks is 20,000,000,000. The annual ton-mileage of the railroads of the United States is 400,000,000,000.

The Shop Executive and His Job

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

HOW THE FOREMAN CAN STABILIZE EMPLOYMENT

In many shops, the foreman plays a very important part in stabilizing employment by planning the size of his working force with the same care that he uses in planning production and the purchase of material. Many foremen are eager to increase their working force as soon as there is a slight increase in business. It should not be forgotten that the hiring of men always involves an expense additional to the wages. A man should not be added to the payroll until as much thought has been given to the need for him as is given to the necessity for the installation of a new machine. The reason why so much less thought is usually given to the employment of new men is that a man can be discharged, but a machine, once bought, cannot.

If the working force is well balanced against the work to be done, the efficiency will be greater. It is the fear of unemployment that often inclines the workman to make his work last as long as possible. A foreman that can assure his men steady employment will be able to make the best showing in economical production. He may not have complete control of this matter, but he can influence it by being careful not to enlarge his working force except when it becomes absolutely necessary.

A. H. RODRICK

POPULARIZING DISAGREEABLE JOBS

In nearly every factory there are two or three jobs on which it seems impossible to keep employes for any length of time. The men either leave the company entirely or insist upon being transferred to another department. In one plant, there were three extremely unpopular and fatiguing jobs which were the cause of rapidly increasing labor turnover and expense. The employment manager demanded that something be done to make these jobs less objectionable and thus cut down the heavy expense. This seemed to be a simple request, but upon investigation, it became obvious that it would be a difficult thing to accomplish without redesigning the machines used on the jobs.

Such a step was not considered feasible until the employment manager showed by figures that the cost of changing the machines would be less than the cost of the labor turnover. The machines were finally redesigned so that they could be operated easily. After this was done, the three jobs, formerly so unpopular, gave the employment manager no further trouble.

Since these three jobs were handled in so successful a manner, it has become the policy of this company to redesign the machinery used for all its so-called "hard jobs," even though the expense involved is not warranted from the viewpoint of production.

There is no doubt that the results obtained in this plant can be duplicated in others. Every case presents a different problem, and should be considered from all angles before a decision to redesign the equipment is made. However, the idea is constructive, and one that every executive may well take up with his employment manager.

HARRY KAUFMAN

"WRITE OUT THE IDEA"

The first step toward obtaining consideration of an idea that is to be submitted to an executive is to put it down in writing. Many good ideas for improving a product or manufacturing method are lost when the idea is told to someone who promises to look into the matter, but who, in the rush of current detail work, forgets all about it. The man who conceives the idea should put it on paper.

The written description should be addressed to the executive of highest authority who will finally pass upon the idea. However, it should first pass through the hands of the foreman and the shop superintendent. They, in turn, will either show the man who originated the plan that it is not feasible, or else pass it on with their endorsements. After the shop superintendent has approved of it, the idea goes to the chief executive who generally has it thoroughly investigated and reported upon in detail by a subordinate.

Thus, by putting the idea in writing at its inception, it immediately obtains the backing of all those who endorse it. Many a good idea is lost because the originator is unable to make its advantages clear in a verbal description.

FREDERICK KAMPMEIR

INSTRUCTING THE MAN WHO CAN'T LISTEN

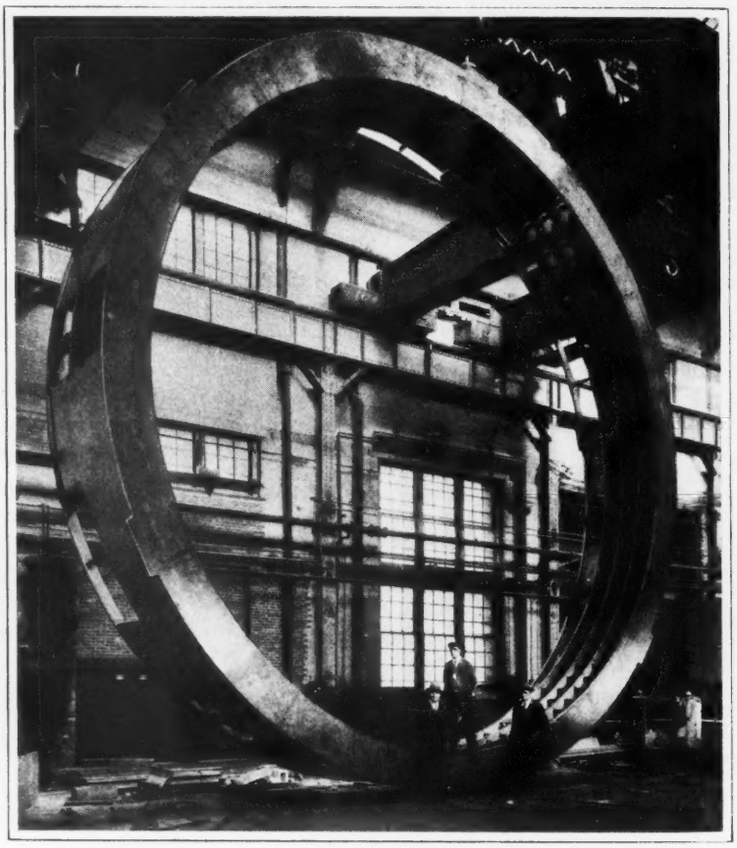
There are some men who seem to be unable to listen to instructions. When an idea is broached to them, their minds immediately run off at a tangent. Because of this characteristic, such men at times do not hear the instructions that are given to them, yet they feel resentful when the resulting errors are laid at their door. These errors may often be avoided by asking the man to repeat the instructions given to him. To ask to have instructions repeated in order to make sure that they have been thoroughly understood is not a bad idea under any circumstances; no one need be offended at such a request, because it safeguards the man receiving the instructions.

BERNARD KAUFMAN

Notes and Comment on Engineering Topics

Huge Hydro-Electric Generator—New Instrument for Making Moving Objects Appear Motionless—A Tailless Airplane Developed in Germany

Among the largest water-driven machines anywhere, both as to capacity and physical size, is the new hydro-electric generator to be installed this year by the General Electric Co. in the generating station of the New York Power and Light Corporation at Spier Falls, on the Hudson River. It will be capable of producing 57,000 horsepower. At present the Spier Falls station has eight waterwheel generating units, but the new generator will have a greater capacity than the eight together. The only generators in this country that will exceed the new machine in weight will be those at Niagara Falls and at Conowingo, on the Susquehanna. The electrical capacity of the new generator—47,000 kilovolt-amperes—puts it second among the three, as those at Niagara are 65,000 kilovolt-amperes, and those at Conowingo are 40,000.



The Frame of the Stationary Element of a New General Electric 57,000-horsepower Hydro-electric Generator. This Frame Weighs Approximately 100,000 pounds

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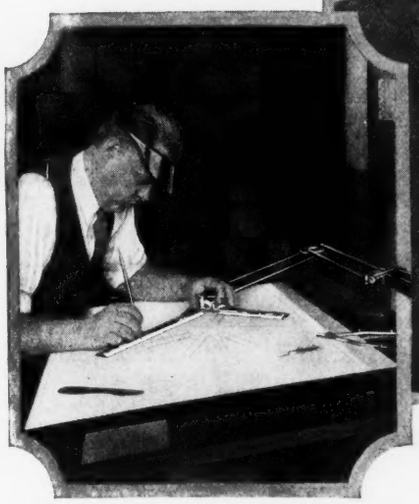
At the last annual meeting of the American Society of Mechanical Engineers, the statement was made that vanadium is used in 90 per cent of all alloy steel locomotive forgings and castings. Vanadium imparts a fine grain and improved strength even when it is present in as small amounts as 0.05 per cent. Railroad men are said to encounter trouble in heat-treating alloy steel forgings. This is due partly to inadequate heat-treating equipment and partly to inadequate experience with alloy steels.

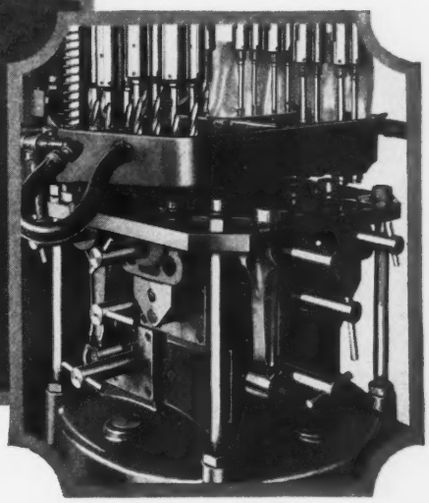
According to a report of the American Welding Society on welding developments in 1929, gas-welding of steel piping systems and overland pipe lines has progressed to a point where welding may be specified safely for any pressures now considered practicable, provided proper procedure is followed in the construction of the pipe line. Gas-welded steam piping operating at temperatures up to 750 degrees F. is now in operation, and gas transmission lines carrying pressures approximating 1000 pounds per square inch have been placed in operation during the past year. Welded hydraulic piping for working pressures as high as 5000 pounds per square inch is also in use. Pipe fittings especially designed for welding are now on the market, and this may be considered evidence of the general acceptance of welding as a suitable method of construction for work of this kind.

A new instrument for making moving objects appear motionless has been developed by the research laboratories of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and is known as the "stroboglow." The instrument is portable and may be used for studying the action of rapidly revolving machinery parts. One way in which the instrument has been used is in studying the action of rapidly revolving airplane propellers. It has also been used for observing the slip of a belt moving on a pulley, the vibration of meshing gears, and the movement of valves in gasoline engines. With this instrument, the difference in revolutions per minute between two machine parts revolving at approximately the same speed can be accurately determined.

A tailless airplane having all the controlling surfaces arranged on the wings was demonstrated recently at the Tempelhof Field, Germany. This machine, known as the "Stork," is shaped like an arrow. An 8-horsepower motor drives a pusher type propeller. It has a speed of 78 miles per hour.



Design of Tools and Fixtures

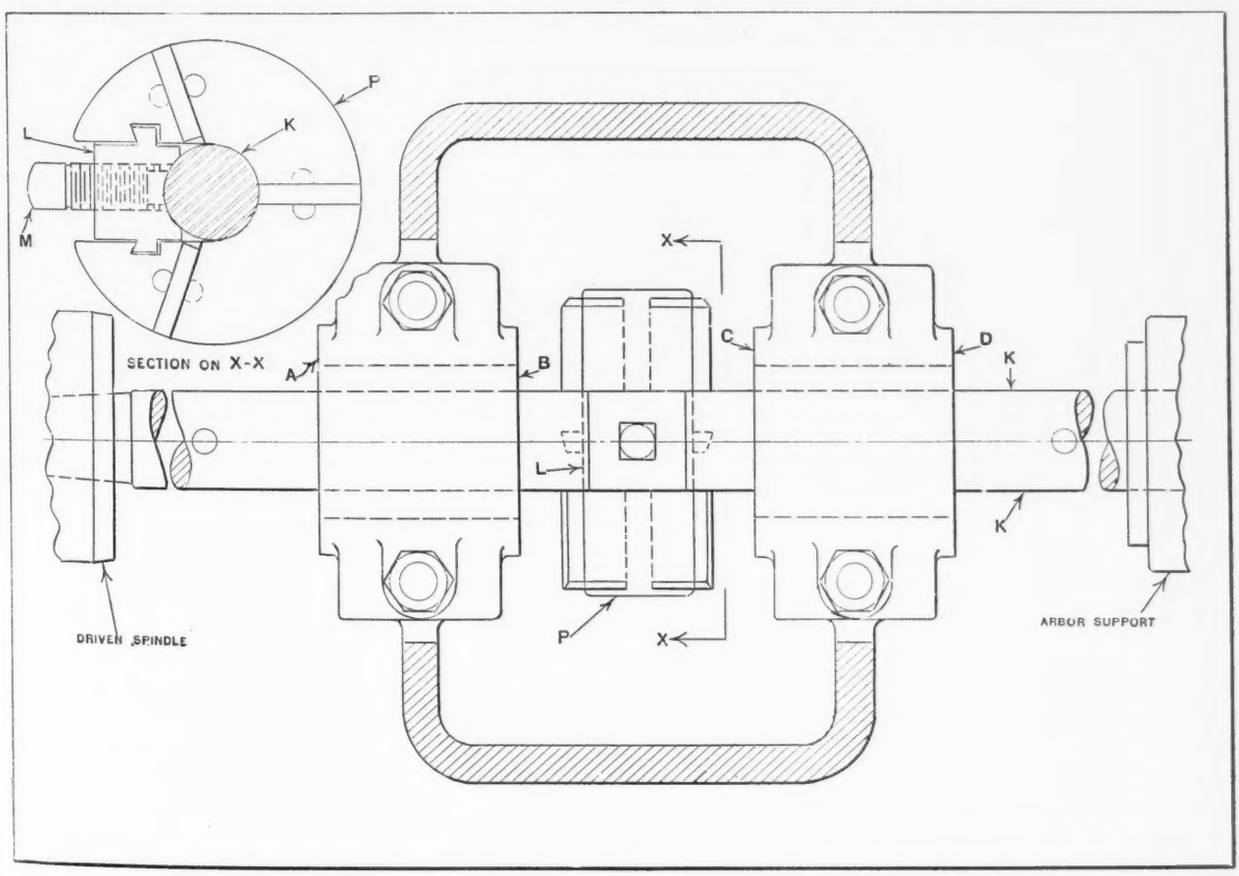


FACING HEAD WHICH CAN BE QUICKLY MOVED ON THE BORING-BAR

By CHARLES C. TOMNEY, Tool Designer,
Brunswick-Kroeschell Co., New Brunswick, N. J.

In some cases it is necessary to do boring and facing in a position that would be ordinarily termed "blind." An example of this kind of work and the method used to overcome the difficulties encountered are indicated in the accompanying illustration. Here a cutter-head is shown that is used for facing the main bearings at *A*, *B*, *C*, and *D* of vertical steam engine frames. The work is done on a large horizontal boring mill equipped with a boring-bar 5 inches in diameter. Formerly this bar was equipped with a cutter-head of the usual type, and as the machine has no rapid power traverse, much time and labor were required to bring the cutter-head to the different facing positions. With the design shown, however, the cutter-head can be quickly shifted to the different points on the bar, only a slight feeding movement then being required to feed the cutters into the work.

The steel cutter-head *P* is bored to fit the straight



By Removing the Dovetailed Block, the Cutter-head can be Quickly Relocated on the Bar

bar *K* and is open at one side so that it may be quickly slipped on the bar. The head is clamped in place by means of the set-screw *M* in the block *L*, the latter having angular projections which engage corresponding grooves in the head. Owing to the angularity of these projections, when the screw *M* is tightened, the head will tend to close up and form a rigid assembly with the block. The bar is spotted at the three required positions of the head, so that the latter may be easily located. For classes of work other than that described, the bar may be spotted to suit. The facing blades are inserted in slots milled in the head and are secured by means of tapered pins.

Two cutter-heads are furnished, one for roughing and the other for finishing. With this arrangement, it is possible to use the same bar both for the roughing and the finishing operations, as it is only necessary to change the cutter-heads. Because of the fact that several sizes of these engine frames are made, three sets of bars were provided to handle the entire line of frames. This design, with some modifications, could be adapted to many jobs similar to that described, resulting in more rapid operation as well as decreased tool cost.

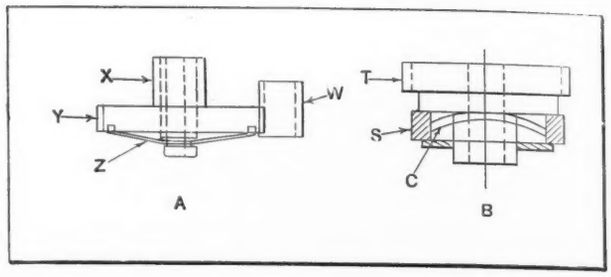


Fig. 1. Two Units of a Water-metering Device

FIXTURES FOR TESTING SUB-ASSEMBLIES

By B. J. STERN, New York City

The fixtures illustrated in Figs. 2 and 3 are used for testing the friction drives of small units that are to be assembled in a water-metering device. The fixture in Fig. 2 is used for testing the unit shown at *A*, Fig. 1. The driving pinion *X* is a light push fit in gear *Y*, and drives the latter through spring *Z*. Gear *Y* drives another pinion *W*. When the load on gear *Y* exceeds a certain amount, spring *Z* slips and thus cuts off the drive to pinion *W*.

To determine whether the slip takes place at the proper loading point, the unit is placed on the testing fixture, as shown by heavy dot-and-dash lines in Fig. 2. Gear *Y* is then grasped by the fingers and turned in a clockwise direction. If the friction driving force of spring *Z* is such as to cause the pointer *G* to pass a certain line on the scale, the assembled unit is rejected as defective. On the other hand, if gear *Y* slips before the pointer reaches this line, the unit is considered satisfactory.

Referring to the construction of the fixture, the pin *B*, shown in section *I–I*, is shaped like a gear tooth and engages one of the tooth spaces in pinion *X* of the unit. Thus, when a unit is being tested, gear *D* turns with gear *Y*. This causes rack *E* to move upward and raise the weight *J*. The upward movement of the rack also causes gear *F* to turn. As the pointer *G* is fastened to the shaft of gear *F*, it indicates the amount of rotation given gear *Y* before the load or weight *J* causes the friction spring *Z* to slip.

At *B*, Fig. 1, is shown another unit that forms part of the water-metering device. Gear *T* is so assembled in the ring *S* that the heavy spring *C* will transmit motion from the gear to the ring. It is important that this spring transmit a certain load before slippage occurs. The fixture for testing this part is shown in Fig. 3.

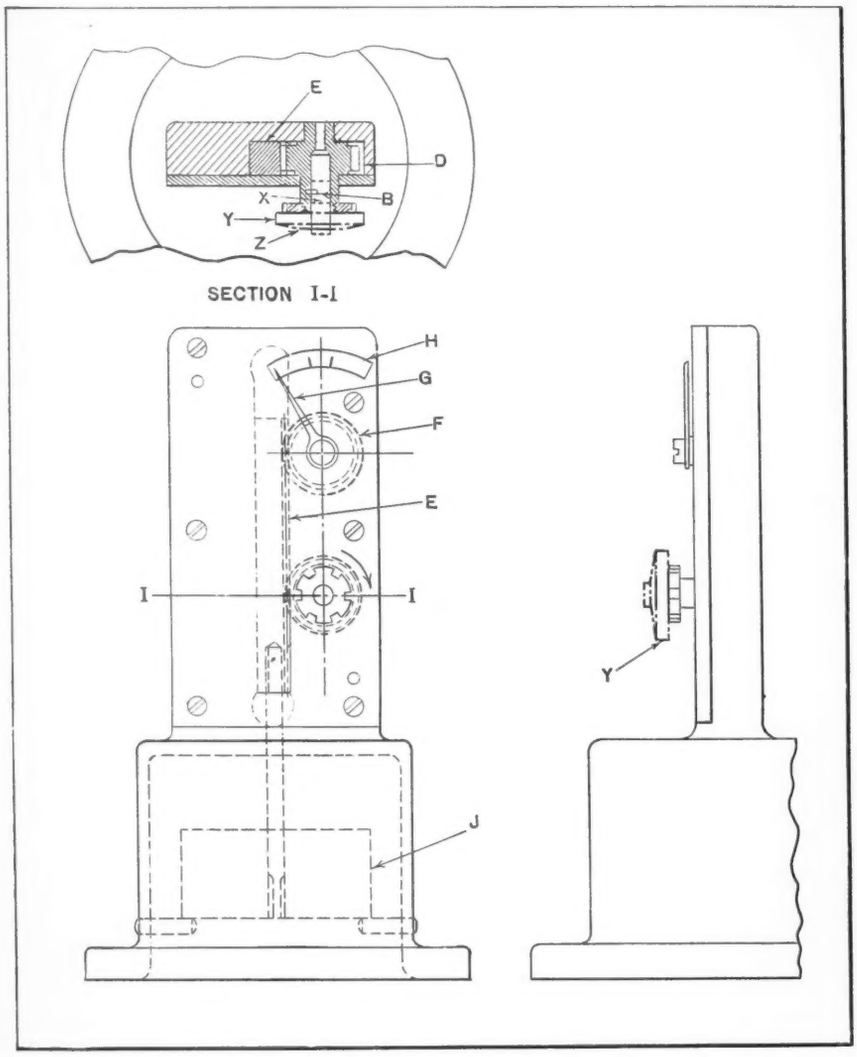


Fig. 2. Fixture for Testing Slipping Point of Friction Drive Used in Unit Shown at A, Fig. 1

An ordinary spring chuck D of the kind generally employed on bench lathes is used to hold the part while it is being tested. The chuck is bored out at E to receive the ring S of the part. At the opposite end of the chuck is secured a short piece of shafting F. Casting G is bored out to receive the spring chuck and to permit the cam H to be properly seated. A pin J is set in the slot in shaft F. This pin is brought into contact with the cam surface on the part H by adjusting the screw K. Now, when the operator turns the cam by means of the handle L, the spring chuck D is drawn downward, causing the jaws to grip the part as shown.

The lever P, mounted on the pivot pin N, carries a thin plate Q which is shaped like a gear tooth. After clamping the unit or assembly in position by means of the handle L, the operator grasps the handle P with the other hand, and brings the tooth Q into mesh with gear T. If gear T can be turned, it is obvious that there is some slippage between the spring and the ring S. When this is the case, the unit is rejected. A girl is usually employed to operate this fixture, and it was found by experiment that the strength of the average girl is not sufficient to cause a properly assembled unit to slip. Therefore, any movement of the gear under test is deemed sufficient reason for rejection.

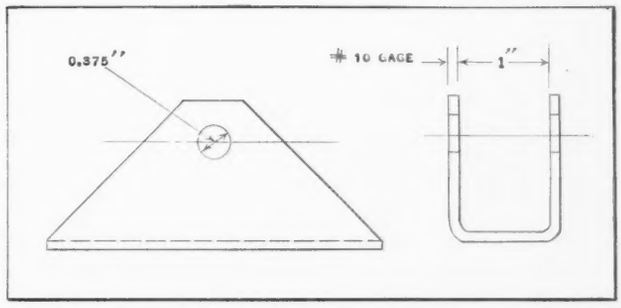


Fig. 1. U-shaped Part Pierced on Die Shown in Fig. 2

DIE FOR PIERCING U-SHAPED PART

By W. E. GUNNERSON, Rockford, Ill.

The piercing die shown in Fig. 2 was designed for producing the two 0.375-inch holes simultaneously in the part shown in Fig. 1. It is necessary that these two holes be in accurate alignment, and they cannot, therefore, be advantageously pierced in the flat blank. As shown in Fig. 2, one punch is held in the upper holder, and the other in the die-shoe. Two round dies B are inserted in a slide C. These dies can be replaced when necessary, a feature which simplifies the upkeep problem.

The slugs or piercings are blown out through the slot D by compressed air. The slide C is kept in

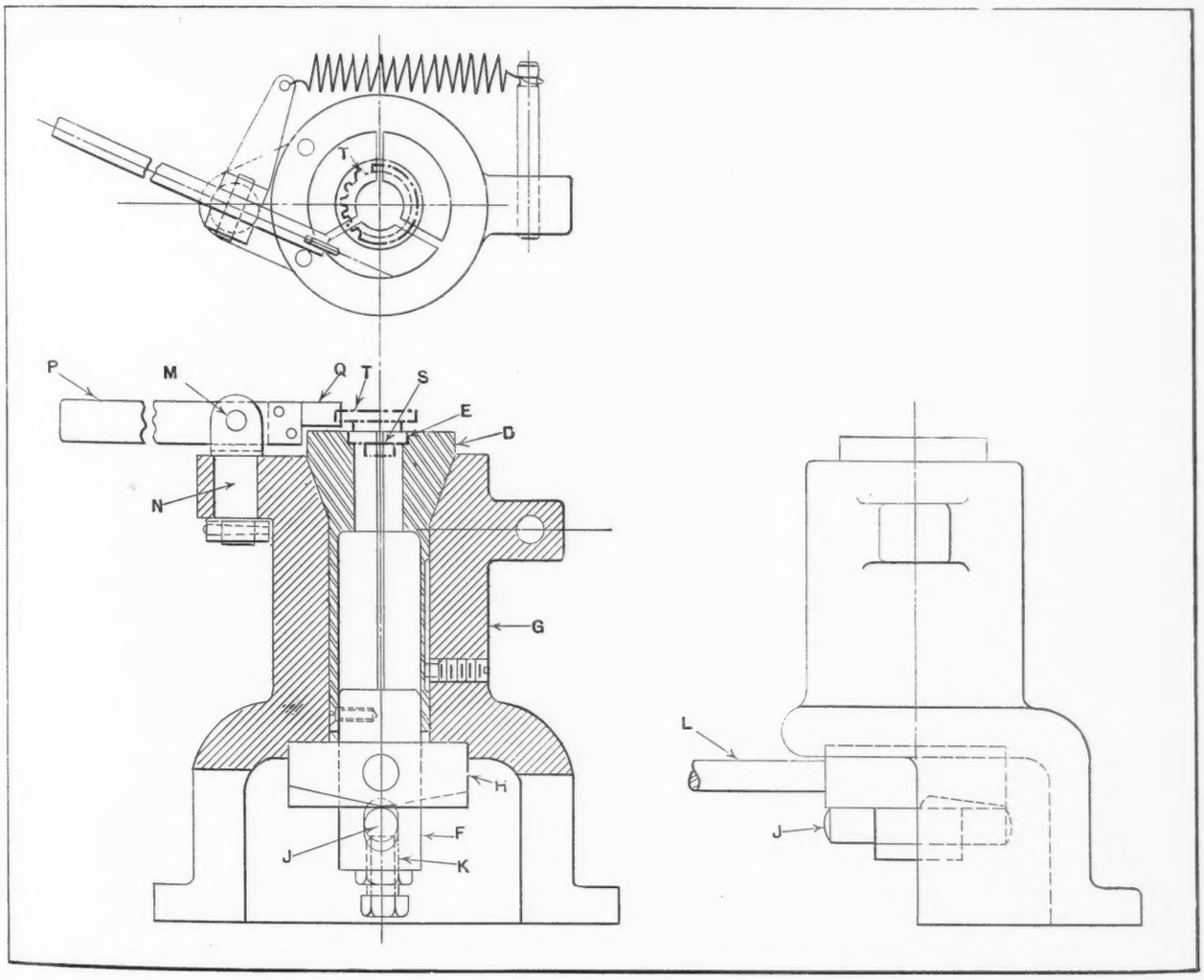


Fig. 3. Fixture for Determining whether Spring in Unit B, Fig. 1, Provides Sufficient Driving Force

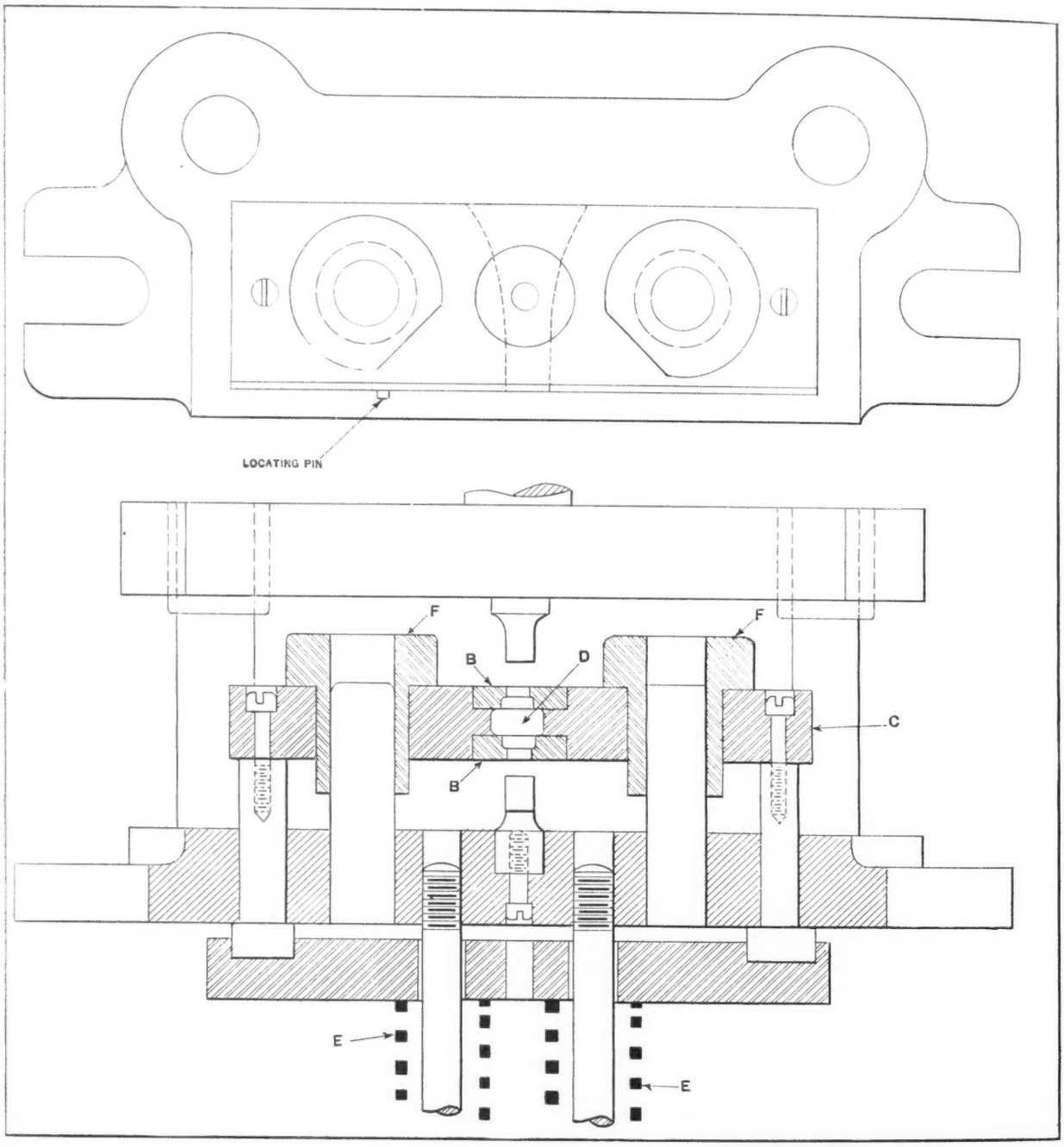


Fig. 2. Die for Simultaneously Piercing Two Opposed Holes in U-shaped Part

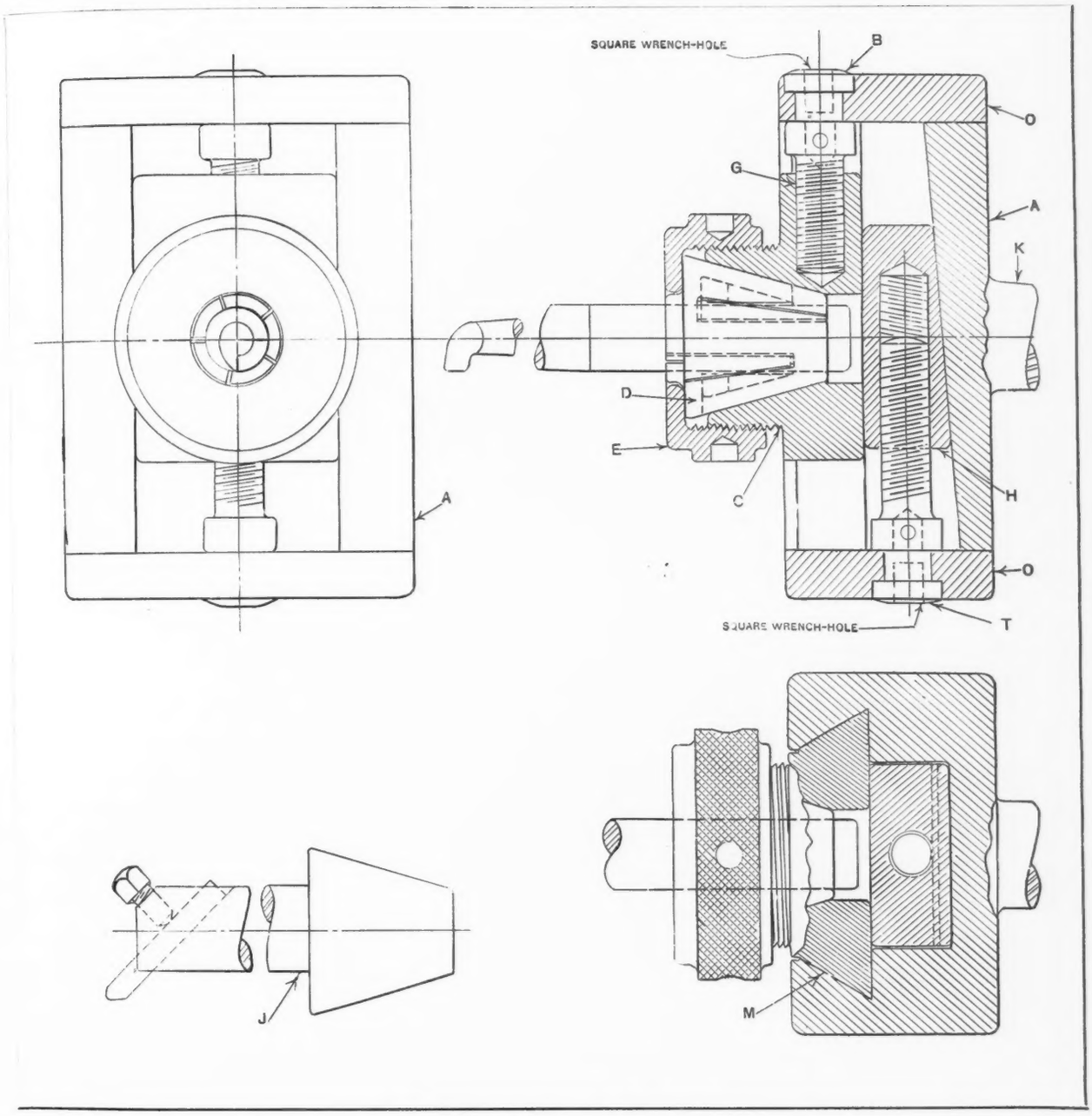
position by two springs *E*. The parts *F* serve both as bushings and as means for forcing the work over the lower punch, the upper punch-holder coming in contact with their upper surfaces near the end of the downward stroke.

BORING HEAD FOR MILLING MACHINE

By ALBERT MILTON THOMAS, New York City

The illustration shows an adjustable boring head designed by the writer for use on milling machines. It is used for boring fixtures, jigs, gages, and similar work requiring great accuracy. The tapered shank *K* is designed to fit either the new or the old standard milling machine spindle. An important advantage claimed for this head is the wide range of adjustment possible. From a position central with the machine spindle the boring-bar has a radial travel of one inch. By setting the bar-holding member on center, the head may be used for drilling and counterboring operations. Furthermore, with this head, uncertain methods of adjusting tool bits for boring in the milling machine are entirely eliminated.

The shank *K* and the body *A* are one solid steel forging, machined, hardened, and ground on all its wearing surfaces. Through the center of the face of the oblong body *A* is milled the dovetail slot *M*. This slot is ground accurately so that the angular sides are as nearly parallel as possible. Immediately below this dovetail slot and on the same center line is a groove in which the locking wedge *H* slides. The wedge is operated by the screw shown at *T*. The bar-carrier *C* is made of machine steel, hard-



Wide-range Boring Head with Micrometer Adjustment for Milling Machine

ened and ground on its working surfaces. One side of this carrier is a close sliding fit in the dovetail slot *M*; on the other side there is a boss threaded for the spanner nut *E*. This boss is bored to fit a number of hardened interchangeable collets *D* in which holes of different sizes are ground to suit the various boring-bars used. In the larger boring-bars, however, these collets are replaced by the solid tapered end, as shown at *J*. These bars are of the inserted-cutter type.

The adjusting screw *G* and the wedge screw *T* are each made in two parts to facilitate the assembling of the retaining plates *O*. A square hole is sunk into the heads of these two screws to fit a wrench. The head of screw *G* is beveled and graduated to 0.0005 inch at *B* to permit close adjustment of the boring-bar in relation to the diameter of the hole being bored. The dovetail surfaces on the carrier *C* are recessed near the center to provide "lands" at four points for obtaining rigidity when the head is locked. The two retaining plates *O* are fastened to the head by means of screws and dowels.

The head is locked by the wedge screw *T* which, when turned, moves the wedge up the inclined bottom of the wedge groove and against the under side of the carrier *C*, holding the latter firmly in place. Incidentally, under test, upon loosening this wedge, no appreciable movement was detected at the end of a 6-inch bar held in the carrier. The writer has found that collets made with an odd number of slots insure a tighter and a more accurate grip. This may be due to the fact that there are no opposing segments, thus allowing a uniform distribution of the pressure exerted on the member held in the collet.

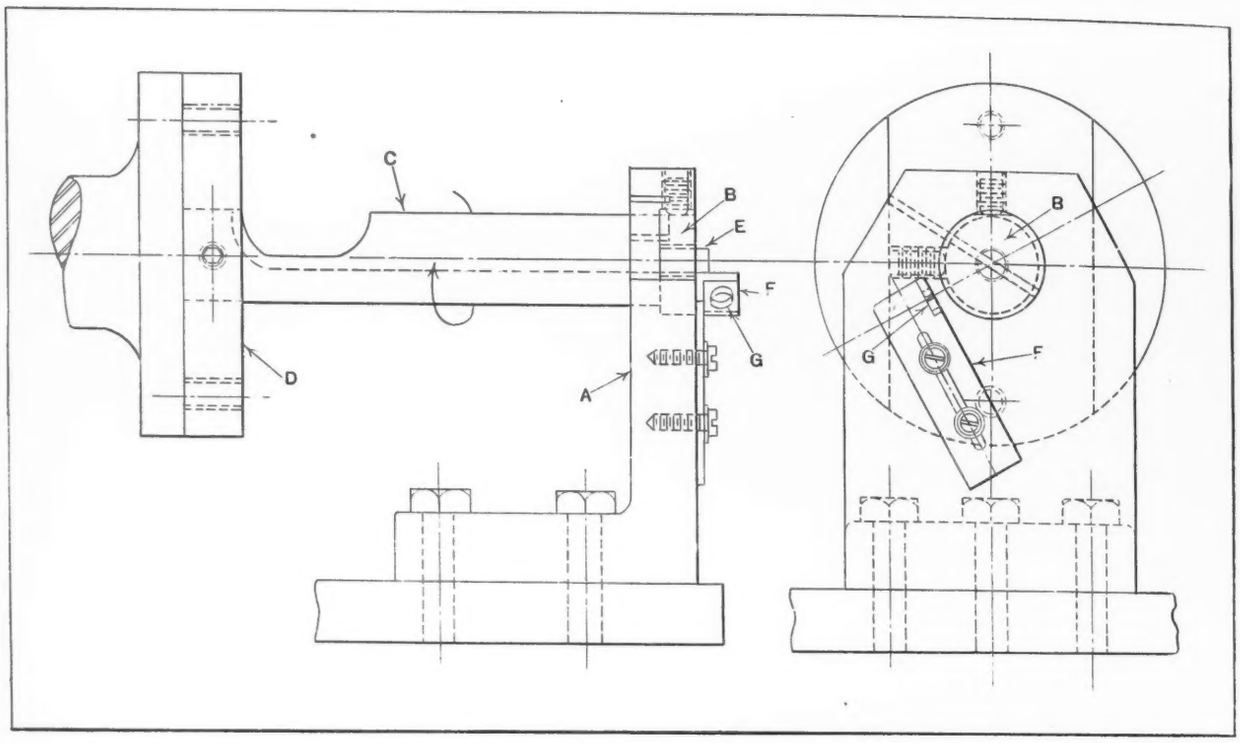


Fig. 1. Device Used on Lathe for Winding Resistance Strips for Rheostats

DEVICE FOR NOTCHING AND WINDING RESISTANCE STRIPS FOR RHEOSTATS

By EDWIN C. ESTEN, Wilbraham, Mass.

One rather perplexing problem encountered in making radio rheostats is the winding of the core or resistance strips. The conventional resistance element of a radio rheostat is a flat strip of insulation material about 1/2 inch wide by 3/32 inch thick wound with resistance wire and formed to a C-shape. The winding must be spaced evenly in notches cut along the edge of the strip. These notches keep the individual turns of wire separated during the forming operation.

With the device shown in Fig. 1, the notching of the edges of the resistance strip and the winding of the wire is accomplished at the same time. In the angle bracket *A* is mounted a special castellated nut *B* which serves as a die for cutting the notches in the resistance strip. The arbor *C* is mounted in the plate *D*, which, in turn, is attached to the faceplate of a lathe. A, slot just wide enough to receive the insulation strip is cut lengthwise of the arbor *C*. The depth of this slot is such that it holds the insulation strip concentric with the arbor and the threading nut *B*.

The nose of arbor *C* is reduced in diameter to a pilot-shaped end which projects through the castellated nut at *E*. The details of the nut *B* are shown in the upper view of Fig. 2. The lower view shows the arbor and nut *B* with a resistance strip or core in place.

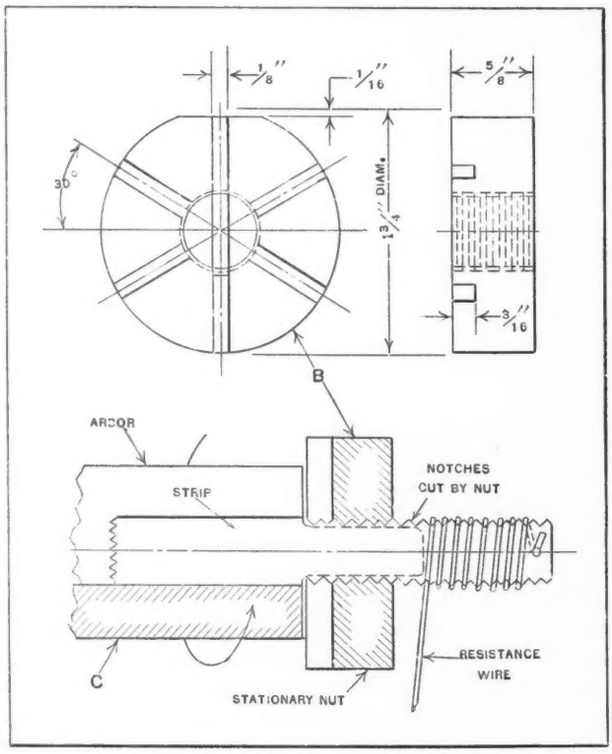
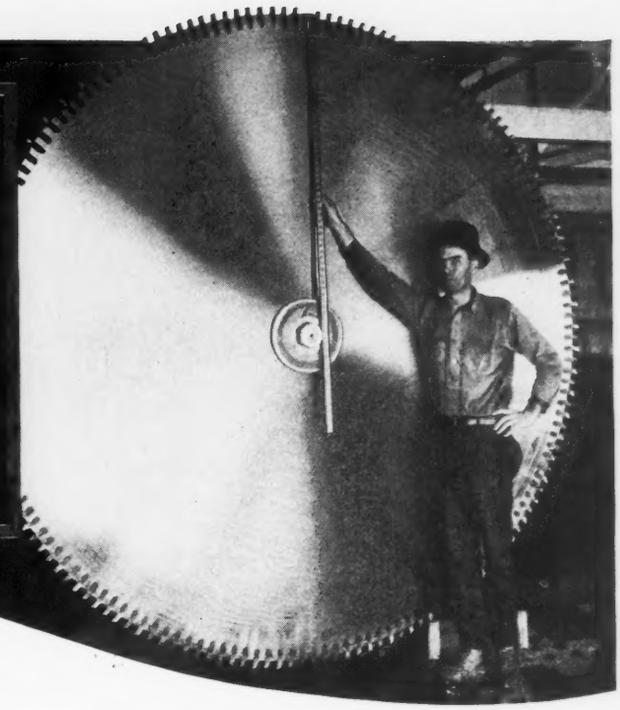


Fig. 2. Details of Notching and Winding Device Shown in Fig. 1

When in use, a core strip is placed in the arbor slot and advanced into one of the slots in nut *B*. As the arbor is revolved, the nut, which is held stationary, acts as a threading die, cutting the thread or notches on the edges of the core strip and advancing the strip along the arbor. When the strip protrudes through the nut far enough, the wire is anchored to its outer end and wound on the strip as it leaves the nose of the arbor. The bracket *F*, Fig. 1, contains a bushing *G* which guides the wire. The spacing of the wire can be changed by using a nut *B* having a thread of the required pitch.

Manufacturing Circular Saws

By J. E. FENNO



Methods Used in the Production of Solid and Inserted-tooth Circular Saws up to 130 Inches in Diameter—First of Two Articles

THERE is not a more common cutting tool than the circular saw. Its application to the cutting of metal, wood, and other fibrous materials is universal, yet there are few who are familiar with the processes involved in its manufacture. For this reason, it is believed that an article describing the operations required to produce circular saws will be of considerable interest. The machines and operations to be described are employed by the Simonds Saw and Steel Co., Fitchburg, Mass.

Alloy steel having a high tensile strength is used both for inserted-tooth saw plates and solid-tooth saws. The steel is received at the plant in the form of thin blanks or disks of diameters to suit the various sizes of saws. Saws up to 130 inches in diameter have been made, although the standard sizes range from 1 inch to 110 inches.

Types of Teeth Used in Circular Saws

Some of the most common types of teeth used on the circular saws made by this company are shown in Fig. 1. For wood sawing, the solid-tooth types shown at *A* and *B* are most familiar; but the inserted teeth illustrated at *C* and *D* usually prove more satisfactory from the point of view of economy. An inserted-tooth saw will outlive a number of solid-tooth saws, because the teeth can be readily replaced when broken or worn out.

The points of the teeth shown at *A* are "set," or bent slightly at an angle to overhang both sides of the saw, no two adjacent teeth being bent in the same direction. The teeth will then cut a kerf or groove slightly wider than the thickness of the saw blade, thus providing sufficient clearance for the blade.

Some saws are swaged instead of set. The swaging operation consists of spreading the point of each tooth an equal amount on both sides of the saw. This type of tooth is shown at *B*.

At *C* is shown the inserted tooth used for sawing with the grain of lumber. The entire edge of the gullet in the plate is milled to form a vee that fits into a corresponding groove milled in the tooth and shank. In sawing, the pressure on the tooth is transmitted to the supporting ledge *a*.

Another type of inserted tooth is shown at *D*. This style is used in saws for cutting against the grain of lumber. Here, a great deal of side clearance is necessary, and this is obtained by the angularity of the teeth relative to the saw plate. The edges of these teeth are grooved to fit tongues milled in both sides of the tooth slots. The teeth are locked in the saw plate by rivets headed over on both ends.

Inserted teeth for metal-cutting saws are of different design, because greater pressure is exerted on the metal saw. Also, as shown at *E*, the part of the tooth extending beyond the saw plate is short and is more rigidly supported. The wedge permits a firmer assembly than is possible with the shank used for wood saws.

Cutting the Center Hole of Saws

The first operation on the rough saw blank is that of punching the center hole. This hole, from which the blank is located for all subsequent operations, is punched on a power press having a deep throat. To locate the blank on the die, a sheet-metal templet of the same diameter as the finished saw is used, in which is drilled a hole slightly larger than the punch. The templet is placed over the blank, and the operator depresses the foot-treadle, causing the ram to descend slowly. When the punch has entered the hole in the templet, the motion of the ram is arrested and the blank is aligned so that its entire periphery will extend beyond the outside edge of

the templet. The descent of the ram is then continued until the hole in the blank is punched out.

This operation, although apparently slow, is done quite rapidly. However, when a large number of blanks are to be punched, a special fixture is used in which the blanks are located between three fixed points; but as a rule, small lots of saws are put through the plant at one time, and then the templet method is more economical.

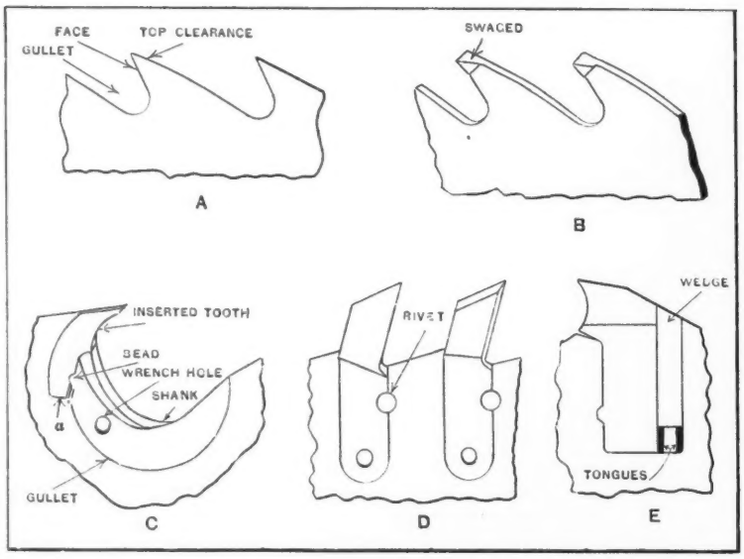


Fig. 1. Solid and Inserted Types of Saw Teeth in General Use

After the punching operation, the blanks are taken to a drilling machine where the holes are reamed and burred. The lock or driving pin holes are next punched, the saw being located on the die by means of a stud through the center hole.

Cutting the Teeth or "Toothing" the Saw

Cutting the teeth in solid-tooth saws and the gullets or recesses in the inserted-tooth saws is done in the press shown in Fig. 2. The saw blank is located on and securely fastened to an indexing fixture at *A*. A ratchet wheel having the same number of teeth as the saw is attached to the lower end of this stud. The ratchet is engaged by a pawl attached to the fixture, for indexing the saw blank.

The operator grasps the edge of the blank and revolves it until the pawl clicks past one tooth of the ratchet. He then rotates the blank in the opposite direction so that the end of the pawl will rest against the face of the ratchet tooth, after which he depresses the foot-treadle. This operation is repeated until all the teeth are cut.

The centering stud and ratchet mechanism are mounted on a slide, and by turning the handwheel *B*, this slide can be moved away or toward the punch to suit the diameter of the saw. The slide may also be swung either to the left or right, so that teeth with different face angles may be cut with the same punch and die.

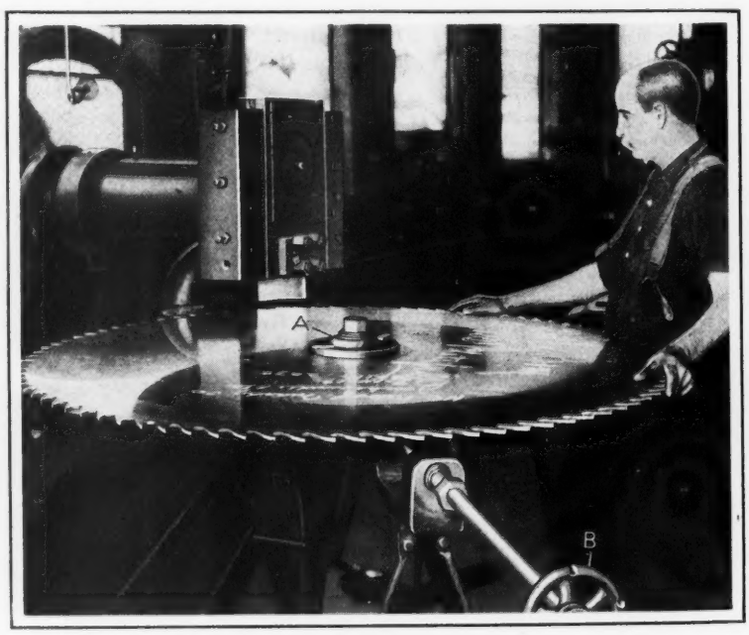


Fig. 2. Toothing Press in which the Saw is Indexed by a Ratchet Wheel and Pawl

After the saws leave the toothing press, the teeth are usually slightly bent and distorted. To remove these irregularities, the periphery of the saws is passed under a rapidly moving flattening punch in a press of the riveting type.

Finishing the Tooth Contour

"Buzzing" the teeth is simply finishing the tooth contour with a grinding wheel to remove the rough edges left by the toothing operation. This operation is done on solid-tooth saws only, the gullets in the inserted-tooth saws being finish-milled.

The saw is located on a stationary arbor in a special grinding machine, and is revolved slowly by hand. As the saw is revolved, the grinding wheel, mounted in a vertically sliding head, is raised or lowered by means of a hand-lever to follow the contour of the tooth. Saws having small teeth, however, are "buzzed" by taking a plunge cut with a grinding wheel shaped to the tooth contour.

Hardening and Tempering the Saws

All saws must be hardened and tempered, both the inserted-tooth saw plates and those with solid teeth. Saws of medium size are put into a regular gas hardening furnace and brought to the required heat. They are then removed one at a time and quickly placed in a quenching press equipped with two hydraulically operated rams located one above the other. The saw is placed between two flat circular plates or dies of large diameter attached to the rams. The operator then moves a lever on the press, causing the two plates to squeeze the saw until it is perfectly flat, after which both rams move downward carrying the saw quickly into a bath

of oil in a vat in the press base. The saw is left in the oil until sufficiently quenched, and is then carried upward, the plates separating enough to allow the hardened saw to be removed with tongs.

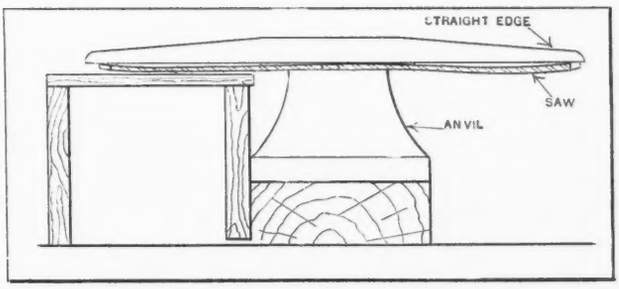


Fig. 3. Light Under the Straightedge Shows that the Saw is Correctly Tensioned

The quenching oil is always in continuous circulation and is kept at a constant temperature by means of a central refrigerating system. To allow the oil to reach practically the entire surface of the saw, and insure effective quenching, the plates on the press rams are honeycombed. The object in squeezing the saw between the ram plates is to correct any distortion produced by the heating.

After quenching, the saw is glass hard and can easily be broken. It is tempered in the electric tempering furnace shown in Fig. 4. The hydraulic ram principle is employed here also for keeping the saws flat while under heat, as otherwise they would become distorted. This furnace has a capacity for about twelve saws, and is divided into two compartments. On the floor of each compartment is fastened a flat plate having a larger diameter than the saws to be tempered. Directly over this plate is another plate attached to a hydraulically operated vertical ram. Separate doors are provided for each compartment.

The operator may be seen inserting a stack of six saws between the two plates. His next move will be to shift the three-way valve lever located above the furnace door, causing the hydraulic ram to move downward. Thus the saws will be squeezed tightly, and be kept flat during the tempering operation. The door is next closed and the hand on the dial above the door set to the time at which the saws must be removed.

After remaining in the furnace for the specified period of time, the saws are removed and allowed to cool in the air. One or two saws in every lot are given the Rockwell test for hardness. Success in the hardening and tempering depends almost entirely upon the heat control, which is obtained with pyrometers.

The hardening and tempering of very large saws is done in a different manner. When a large saw is to be hardened, it is first brought up to the required heat in a regular hardening furnace. Then it is removed and plunged into a large tank of oil sunk into the ground near the furnace. After quenching, the saw is placed in a tempering furnace and held between two slowly rotating plates somewhat larger in diameter than the saw. Thus, by revolving the saw, it is given a more uniform heat than would be possible if it remained stationary. After it has been left in the furnace the specified period of time, it is removed and allowed to cool slowly in the air.

Straightening and Tensioning, Generally Known as "Smithing" the Saw

"Smithing" is the process of straightening and tensioning a saw, and requires a high degree of skill which can be attained only after many years of training. It is the most skillful operation in saw making. The tools used by the saw smith are few. They consist chiefly of a set of hammers, straightedges, and an anvil.

The tempered saw is first flattened by laying it on the face of the anvil and hammering out all lumps and hollows. After the saw has been made perfectly flat, it is given the first "tensioning," an operation to be described shortly.

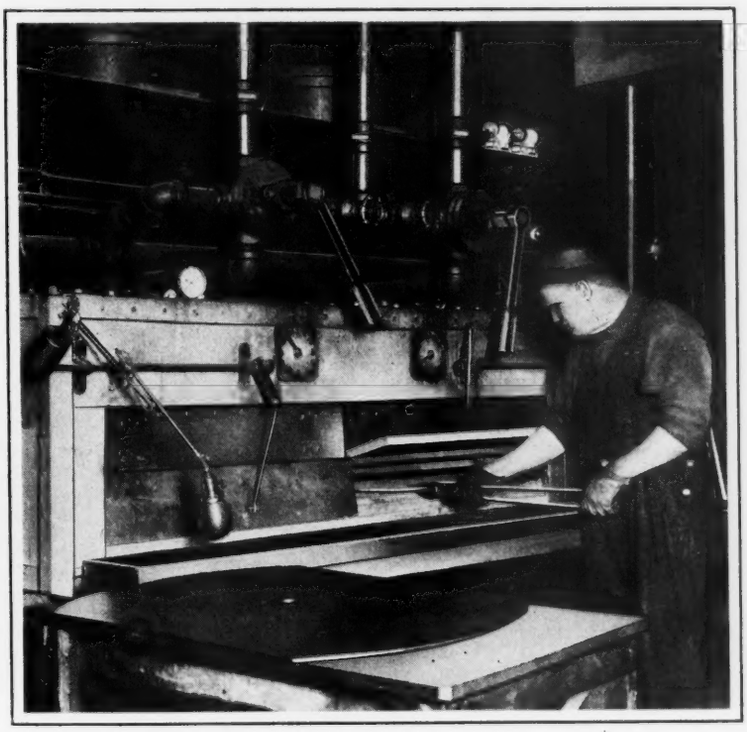


Fig. 4. Tempering Furnace in which the Saws are Kept Flat by Means of Hydraulic Rams

It is obvious that the centrifugal force resulting from the rotary motion of the saw when in use will produce a tension or strain in its rim, stretching the latter slightly. Heating, due to the cutting action of the saw and the clogging of the teeth with sawdust, will also produce a like result. The free stretching of the rim, however, will be restricted unless the metal around the center of the saw is "loosened." If the stretching of the rim is restricted, it will become wavy and the kerf cut by the saw will be irregular.

The object, therefore, of tensioning is to permit the free stretching of the rim of the saw while the latter is in operation. The tensioning operation consists of hammering the saw on an anvil until a certain curvature is produced, as indicated in Fig. 3 by the straightedge that is placed on the saw. This curvature extends all around the side of the saw, concentric with the center hole.

Grinding the Sides of Saws

In the machine shown in Fig. 5, the saws are ground on both sides to a thickness governed by a thickness gage. They are given a combined rotary and reciprocating motion as the grinding wheel is forced against them. The side of the saw opposite the side being ground is supported against the pressure of the grinding wheel by a hardened and ground block fastened to the machine base. After one side is ground, the saw is reversed and the other side finished.

The saw is mounted on an arbor clamped in the block *A*. This block is cast integral with the saw carriage *B* which slides on the ways of the machine in a direction parallel to the face of the grinding wheel. The sliding motion of the carriage is effected by a hydraulic feed controlled by the three-way hand valve *C*.

While being fed across the grinding wheel, the saw is given a rotary motion by means of two friction rolls, one on each side of the saw. These rolls, one of which is shown at *D*, are forced against the saw by turning crank *E*. The rolls are driven by a belt passing over a pulley on the end of one of the roll shafts, while motion is transmitted to the other shaft through the medium of spur gears.

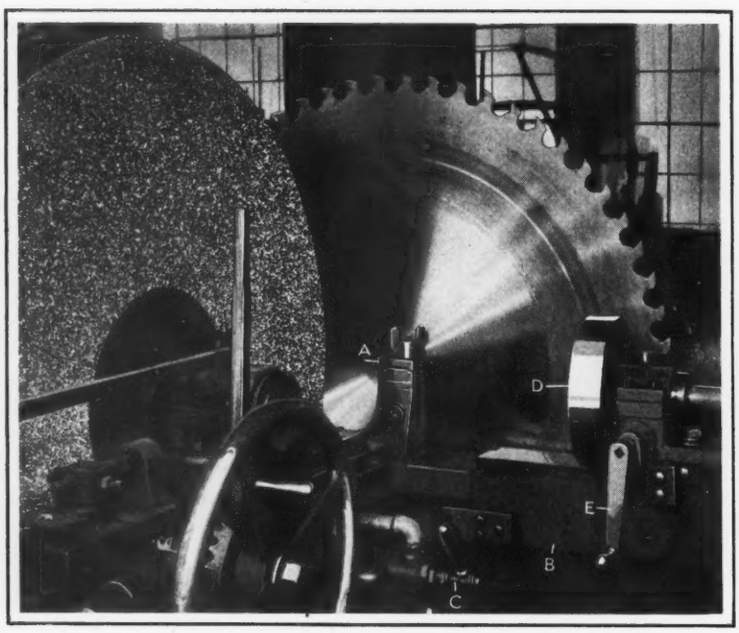


Fig. 5. The Saw, Mounted on the Arbor, is Given a Combined Revolving and Reciprocating Motion while Being Ground

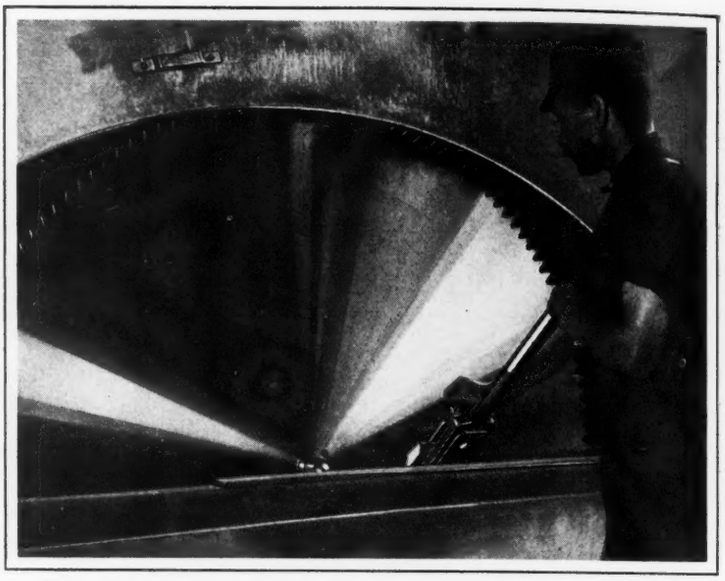


Fig. 6. Polishing a Saw by the Application of an Abrasive Block Secured in a Wooden Handle

The grinding wheel can be moved to or from the saw by a handwheel. The wheels used for grinding the larger saws weigh as much as eight tons. The base under the grinding wheel forms a reservoir and is kept partly filled with water to lubricate the wheel.

Polishing the Saw

A saw is polished not only to improve its appearance but also to reduce the friction on the sides while sawing. In the polishing machine shown in Fig. 6, the saw is mounted on a shaft and polished while revolving at a high speed. A protective casing around the saw eliminates danger in case the saw should break and fly apart. The polisher uses a wooden handle in which a block of emery is clamped. Holding the handle at the angle shown, he rests the lower end on a steel bar fastened to the casing, at the same time forcing the emery block against the side of the saw. The block is moved slowly from the edge of the hole in the saw to the points of the teeth until a smooth surface is obtained.

The polisher then replaces the emery block with a block of cork and goes through the same movements, keeping the block dusted with fine emery flour. This operation is followed by cleaning the sides of the saw with cotton waste and oil to remove the emery. The saw is then reversed and the other side polished.

Etching Trademarks on Sides of Saws

To etch the trademark on the saw, a special inked paper bearing the trademark outline, is laid on the side of the saw. The paper is then sponged with kerosene, after which it is peeled off, leaving the inked outline on the saw. This outline is next covered with nitric acid

and left for approximately 1/2 minute to allow the acid to eat into the part of the saw left uncovered by the ink. Both the ink and acid are then removed, leaving a well etched trademark on the saw.

In July MACHINERY a second installment of this article will be published. This installment will deal with the so-called "fitting" of the teeth in solid-tooth saws, the milling of the gullets for inserted teeth, and the methods of assembling inserted teeth into saws, as well as with the forging, milling, hardening, tempering, and sharpening of the teeth themselves.

Why Are So Many Obsolete Machine Tools Used?

By FRANK W. CURTIS, Research Engineer, Kearney & Trecker Corporation, Milwaukee, Wis.

While the use of obsolete equipment is usually nothing more than a sign of poor management, there are a few cases where the practice is to be excused. Generally speaking, there are four reasons for the use of so-called "obsolete" machinery. These are: (1) Lack of funds for the replacement of out-of-date machines; (2) lack of progressiveness on the part of the management; (3) ignorance of the trend of modern machine tool design; and (4) instability of the product being manufactured.

In the first class there may be cases where other things, such as new buildings or plant extensions, are needed first, or the firm may be small and growing slowly, or the business may be so quiet that profits do not warrant the purchase of new machinery. In such cases, an effort should be made to finance the purchase of new machines as soon as possible, because continued operation with old equipment will eventually cause a complete paralysis of the shop. Then there will be so many machines to buy that an unusually large sum of money will be needed immediately, or failure will be inevitable.

Machinery is the backbone of almost any business where it is used, but the management too often overlooks its influence on the accuracy, output, and cost of the product being made. Some plant officials, unfortunately, do not keep a check on machine efficiency, but leave the matter in the hands of shop foremen. These foremen, though they may be good as producers, usually do not foresee the need of new machine tools. Consequently, inadequate equipment continues to decrease the output and to increase shop losses.

A Shop Manager Must Keep Informed on Improvements in Machine Tools and Shop Methods

Every shop manager must keep informed on machine tool developments. To be ignorant of what is being done by machine tool builders in the way of new equipment is as serious as attempting to operate a shop without a cost system. Cemented tungsten-carbide tools, for example, have necessitated many changes in machines during the past year, and the shop manager must know just what progress is being made, because soon he will be required to consider these tools, and will have to install equipment suited to their use. The manager who does not know what is being done in this direction, for example, has reached the peak of his progress and is gradually paving the way for others to pass him. Likewise, his shop is suffering from the consequences of his lack of information.

When the output of a product requiring special-purpose machinery is not definitely known, it may be advisable to use standard equipment; but modern tools must be provided if the present equipment is obsolete.

Very few people like to drive an automobile that is three years old or older. The upkeep cost mounts rapidly and soon becomes serious. Machine tools are no different, although their period of life may be slightly longer than that of an automobile. Yet some who look at their automobiles with much pride fail to consider their shop equipment.

A Record of the Production Capacity of Machine Tools is Needed in Every Shop

Every plant, regardless of its size, should keep a machine efficiency index, revised semi-annually, to show the current value of the machine equipment from the standpoint of output. The purchase cost and the present appraisal value do not necessarily have to be considered; in other words, the value of the machines as producers should be estimated. For example, it is usually assumed that a new machine is 100 per cent efficient. If in six months a more modern machine is produced, say one that will produce 15 per cent greater output, then the machine in hand will be only 87 per cent efficient. If in another six months some other machine will enable a 25 per cent greater output, then the efficiency will fall to 80 per cent, and so on. The efficiency rating is gained by dividing the present output by the estimated output that a more modern machine would give. On the other hand, a machine may remain 100 per cent efficient for a year or more, as far as output is concerned, but it will have less value because of wear. Then, naturally, the efficiency curve will fall.

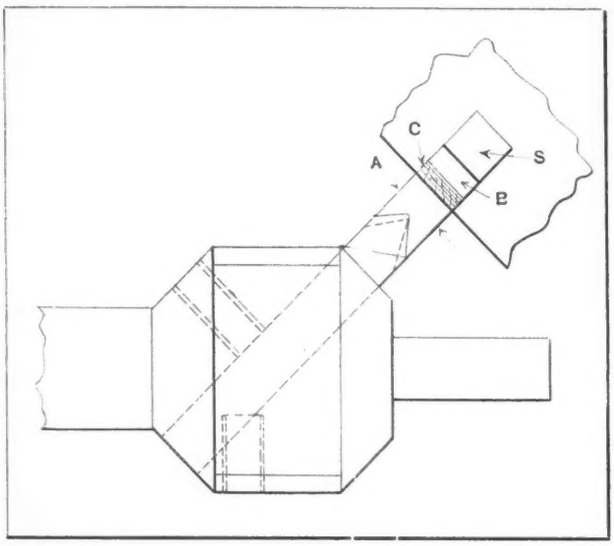
With every machine recorded in this way, the mean average will show the group efficiency. While it would be difficult to maintain 100 per cent efficiency at all times, the average plant ought not to fall below 90 per cent, especially when competition is keen. The obsolete machines that lower the average machine efficiency should be replaced. Shop executives who overlook their machine efficiency are likely to meet trouble. Too much attention cannot be paid to this vital question; every shop executive who expects to be successful must find out what is being done for him by the machine tool builders.

Ideas for the Shop and Drafting-room

Time- and Labor-saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

MAKING SQUARE SLOTS IN BORING-BARS

A milling and a welding operation have been satisfactorily substituted for broaching in the production of tool bit slots in boring-bars when a



Boring-bar with Square Tool Slot Produced by Milling and Welding

boach of the correct size is not available or when it would be difficult to perform a broaching operation. Referring to the accompanying illustration, it is simply necessary to mill a slot to the required depth with a cutter of the proper width *A*. The filler piece *B* is then located in the slot and the space *C* filled in by arc-welding. This completes the slot *S*.

Rockford, Ill. WALTER E. GUNNERSON

INDICATING THE KIND OF FINISH ON DRAWINGS

The well-known finish mark or symbol "f" on drawings of cast parts conveys to the patternmaker all that he needs to know about the finish. His knowledge of foundry and machine work will enable him to make the proper allowance for machining the surfaces that are to be finished. When castings or other parts come to the plant for machining, however, both the quality of the finish and the dimensions must be indicated.

A piece may be considered finished if it comes within the specified tolerance, yet it may be entirely unsuited for the service for which it is intended. For example, a shaft may be turned to the required diameter of, say, 8.000 inches plus or minus 0.005 inch, but if the final cut is taken under a coarse feed, the finish of the bearing surface will, in all probability, be entirely too rough.

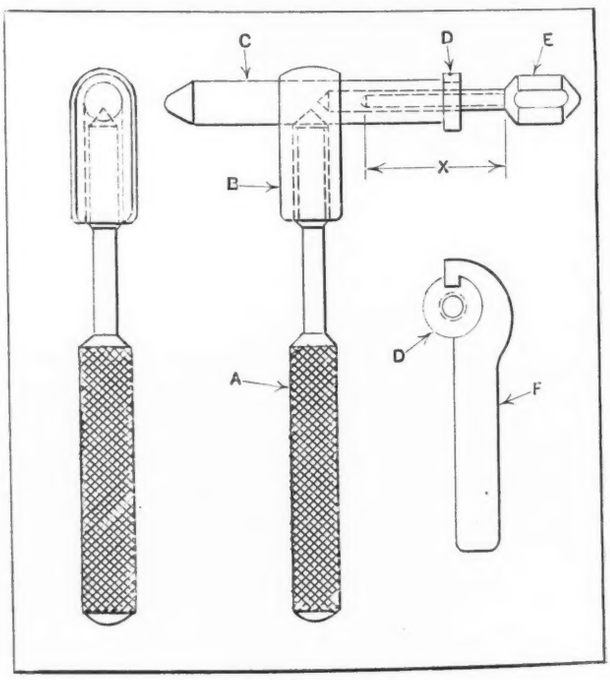
The designer must indicate, unmistakably, on the drawing exactly the kind of finish he desires. Unfortunately, no symbols have been universally adopted for this purpose, and until some standard system is devised, notes will have to be resorted to.

Any plant, however, that controls all the manufacturing operations involved in converting raw materials into the finished product can easily develop a set of symbols which, if applied throughout the plant, will soon become recognized by the workmen. When once established, these symbols will become as much a part of the drawings as the dimensions. Such symbols may, for example, indicate the following classes of finish: Rough tool finish, fine tool finish, coarse file finish, fine file finish, grinding, lapping, polishing, burnishing, scraping, reaming, honing, chipping, or painting.

St. Louis, Mo. PAUL H. WHITE

ADJUSTABLE PIN GAGE

The adjustable pin gage shown in the illustration was designed for use on special parts and experimental work, in order to avoid the comparatively high cost of plug gages, which so frequently become obsolete. Later it was found that this type of gage was also suitable for use as a "Not Go" limit gage for blind holes, and that a pair would make excellent "Go" and "Not Go" gages in recesses large enough to permit them to be entered by tipping.



Pin Gage that is Especially Adapted for Measuring Blind Holes

The plant in which the writer is employed is equipped with a set of these pin gages for measuring holes ranging from 1 1/2 to 2 inches by 1/4 inch steps, and from 2 to 6 inches by 1/2 inch steps. This range, however, can be increased by using auxiliary anvils of varying lengths at *X*.

The body *C* and the adjustable anvil *E* are made of drill rod and hardened on the contact ends. After being screwed together and set to size by gage-block set-ups or micrometers, they are rigidly locked by the nut *D*, which is tightened by means of the spanner wrench *F*.

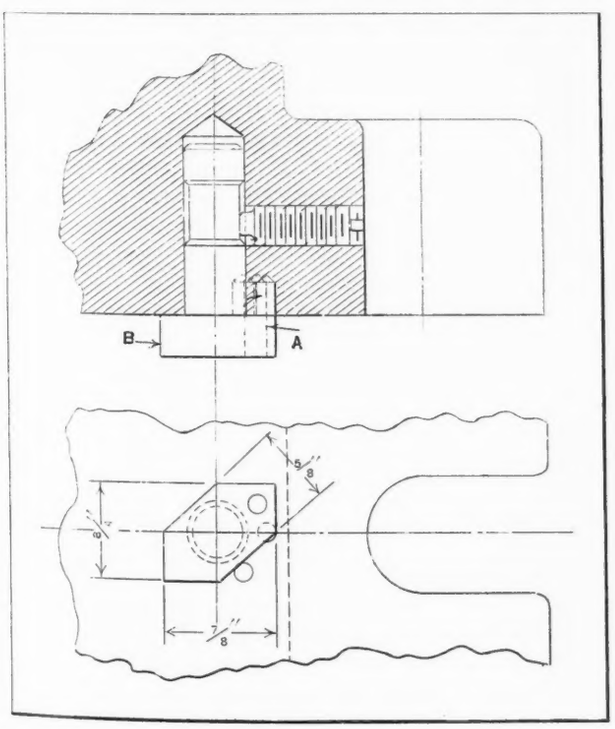
The gage may be used either with or without the holder *B* and handle *A*, although these members greatly facilitate the measuring of blind holes. The pointed end of the handle fits a countersunk depression in the body *C*, and by screwing the handle tightly in member *B*, the combination is locked together. This design can be constructed economically, and is free from the usual gage upkeep costs.

Aurora, Ill. A. J. WORMWOOD

COMBINATION FIXTURE KEY

It is often necessary, in designing milling machine fixtures, to provide more than one set of keys in order to be able to use the fixture on other machines having slots of different sizes. These loose keys frequently are lost, causing much waste of time. The combination fixture key illustrated was designed to overcome this trouble. It is applicable to slots of different widths.

By loosening the set-screws, the keys *B* can be pulled out until the ends of the dowel-pins *A* clear the bottom of the fixture. The keys can then be swung to any one of three positions to suit three different widths of table slots. The keys are then pushed into the fixture, the dowels *A* entering other holes to prevent rotation of the keys. After tightening the set-screw, the fixture is ready for use.

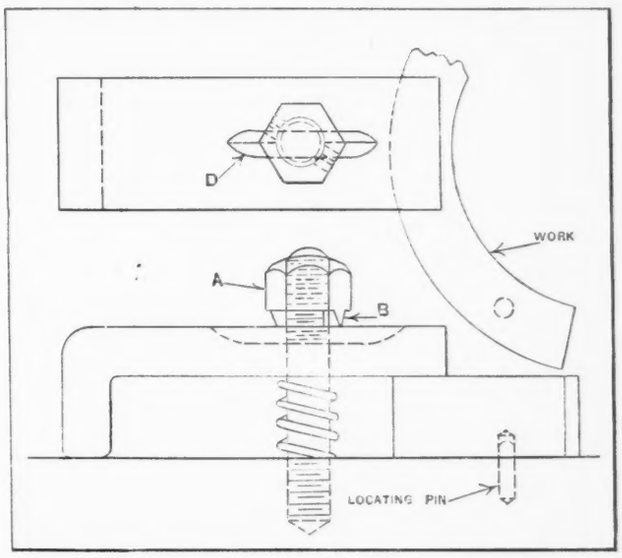


Fixture Key which Can be Set to Fit Table Slots of Three Different Sizes

Fairfield, Conn. F. E. JUDSON

QUICK-ACTING FIXTURE STRAP

A quick-acting strap of simple design is shown in the illustration. Straps of this type have been used successfully by the writer for holding work in jigs and fixtures. The construction permits the work to be clamped or released by turning the nut *A* less than one-quarter turn. The bottom of the nut is milled across to form the beveled support shown at *B*, and a V-groove *D* is milled in the strap.



Fixture Strap Operated by Revolving Nut One-quarter Turn

Previously, when a standard nut was used, it was necessary to spin the nut several turns to permit the strap to be raised enough to allow the work to be removed from the locating pin. With the simple design shown, however, the nut is simply turned back until the beveled support *B* is in line with the V-slot *D*. The coil spring then raises the strap until the V-groove engages the beveled support. Both nut and strap are pack-hardened to resist wear.

Seneca Falls, N. Y. WILLIAM E. CROSS

PROLONGING THE LIFE OF DRAWING INSTRUMENT ADJUSTING SCREWS

A simple method of prolonging the life of the adjusting screws and nuts of drafting instruments is to squeeze the screw between the smooth jaws of a vise. This changes the round thread into one of elliptical form, thereby increasing the diameter on one axis and creating a fit in the nut.

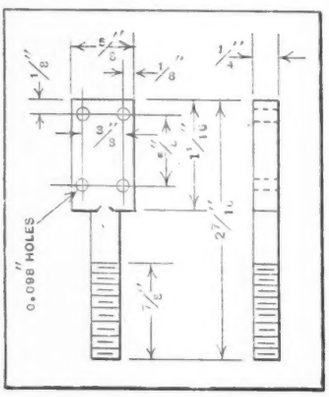
The nut is the part that usually wears out first, and it may be treated in the same way, but it is better to treat the screw as described instead of the nut. By enlarging the screw its threads will have a bearing on the unworn portion of the nut thread.

D. A. H.

Questions and Answers

PIERCING HOLES IN BRASS PART

F. K. A.—We would like to know the best method of piercing or perforating the four 0.098-inch holes in the part shown in the accompanying illustration. The material to be used in making this part is half-hard brass strip stock. It is desirable to avoid, as far as possible, any appreciable bulging of the part at the sides near or adjacent to the holes. The pieces are to be made in large quantities. Can any of MACHINERY'S readers describe a satisfactory method of handling this job?



Brass Part with Four Pierced Holes

Answered by Jacob H. Smit, Newark, N. J.

It is the writer's opinion that the piercing of the four holes in the brass part shown cannot be effected with any degree of success, even in the case of large quantities. Continual breaking of the punches is very likely to occur. In order that a punch may operate satisfactorily, its diameter should be greater than the thickness of the part pierced. The more satisfactory method would be to drill the four holes. This could be done simultaneously by means of a multiple drill head and a drill jig. Of course this head would be small, but by heat-treating its working parts properly, no trouble should be experienced.

If it is desired to obtain high production on this part, a hopper may be incorporated with simple feeding fingers for locating the pieces in position on the jig, and the work ejected by means of compressed air. The latter would also aid in removing the chips from the jig.

GRAY FINISH FOR TOOLS

L. R.—Is there a simple method or process for producing a gray finish on hardened and tempered tools, such as milling cutters, reamers, etc.?

Answered by William C. Betz, New Britain, Conn.

Hardened carbon or high-speed steel tools can be given a gray finish by heating them for hardening in a salt bath furnace of the Bellis type. A very thin coating of salt adheres to the work. When the tools are quenched, this comes off, leaving the work a nice gray color. It may be necessary to wash the tools in hot water to obtain a uniform color. Another method of producing a gray finish is by sand blasting, but this process is more expensive, because it requires special equipment.

Gray finishes can also be produced by the use of acids and alkalis. An acid solution known as "Nitol," containing 98 per cent alcohol and 2 per cent nitric acid, is used. The work is immersed in this solution and left in it until the desired shade of gray appears. It is then washed off in cold water to neutralize the acid, after which it is placed in hot water, dried, and oiled.

An alkali mixture for producing a gray finish can be made up of a saturated solution of caustic soda with an ounce of saltpeter to the gallon. This dip must be strained and used hot. The work should be clean, and care must be taken to remove it from the bath instantly when the desired color appears. It should then be washed, dried, and oiled, as in the case of the acid dip. In using either acid or alkali dips, it is important to remove the work as soon as the desired color is obtained, as otherwise it will gradually turn black.

Answered by John D. Riggs, Indianapolis, Ind.

A method that the writer once used for obtaining a gray color on cutters for shearing paper, made from hot-rolled sheet tool steel, is as follows:

The cutters were about the size of a dime and their peripheries were beveled to a sharp edge. Several of the cutters were placed in a ladle and heated. After being warmed slightly, they were sprinkled with a casehardening material, as suggested in MACHINERY'S SHOP RECEIPTS, composed of seven parts yellow prussiate potash, one part bichromate potash, and eight parts common salt. This composition was pulverized and well mixed. Enough of it was used so that when melted, it covered the entire surface of the cutters.

The contents of the ladle were then stirred gently and the temperature increased until the cutters became a dull red. This temperature was maintained for a period of ten or twelve minutes until the black scale on the cutters was completely dissolved; then the heat was brought up to a hardening temperature, and the mass of cutters, with the compound, was dumped from the ladle into water or brine for quenching. The action of the compound on the steel was much the same as that of an acid, giving a muddy white color that was very clean and uniform.

After thoroughly cleaning pieces treated in this manner, it is further suggested that they be lacquered or varnished, in order to preserve their finish. For cast iron, the writer has used a solution of one part linseed oil thinned with five parts turpentine. In other cases gasoline in which paraffin shavings have been dissolved may be used for this coating.

Answered by R. A. Dressler, Chief Engineer, Millersburg Reamer & Tool Co., Millersburg, Pa.

There are two very good and simple methods of producing a gray finish on tools. The more common method is sand-blasting; this is suitable for both high-speed and carbon tool steels. Another method that has been used successfully for years in a number of large tool plants is the hydrochloric acid treatment. This process, however, will not produce a gray finish on high-speed steel tools, but it can be employed successfully for carbon and ordinary alloy steel tools. Strict adherence to the procedure described is necessary, as any deviation may cause the tools to become black or rusty. The process may be divided into four distinct stages:

First Stage—The tools should be heated to a temperature of 212 degrees F. They should be cleaned from grease and oil by boiling them in a good metal cleaner solution (Wyandotte metal cleaner has been found very satisfactory). The work should remain in this solution at the boiling point until heated through. If not thoroughly heated, it must be reheated to 212 degrees before entering the next stage of the process. In the event that the tools have been heated for hardening in a box furnace or open fire or have been oil-hardened, all loose scale should be removed with a wire brush and scraper. If the work has been heated in a lead bath, the lead must be scraped off; otherwise the finish will be spotty. Rust need not be removed, as it accelerates the action of the acid.

Second Stage—Assuming that the tools are now at a temperature of 212 degrees F., they are placed in an earthen, glass, or stone receptacle containing concentrated hydrochloric acid and pickeled until all the remaining scale is dissolved. Terra cotta troughs can also be used as containers for the acid. The tools should remain in the acid until the desired degree of grayness has been acquired and no longer, as the acid will eat away the sharp edges and corners. A piece of work may be lifted out of the solution occasionally with a pair of tongs and inspected to ascertain the color. The piece should not remain in the air longer than a few seconds, as the air will cause it to turn black.

Third Stage—The work is now removed from the acid. A piece or a few pieces at a time are removed with the tongs and washed off quickly in a trough of clear cold running water. The part should be agitated in the running water to rid it entirely of the acid as soon as possible. The water cleansing trough should be located close to the acid trough, so that the work need not be exposed to the air longer than is absolutely necessary.

Fourth Stage—To neutralize any remaining trace of acid, the tools are placed in a soluble oil solution such as "Solcut," in the proportion of one part of "Solcut" to fifty parts water, held at a temperature of 140 degrees F. The work should be allowed to remain in this solution until it has reached the temperature of the bath. The parts may then be removed and carried into another room which is free from the fumes of the room containing the acid baths. The work is then wiped dry and clean with waste to prevent rusting.

Considerable heat is generated by the action of the acid on the steel, and the acid gradually becomes weaker. When it has been so weakened that it no longer produces a good finish, it should be thrown out. It is false economy to add new acid to the old or weakened acid. Alloy steels should be allowed to remain in the acid a greater length of time than straight carbon steels. If this process is carefully followed, a velvet-like gray finish will be produced.

MATERIAL FOR DIE-CASTING DIES

T. W. T.—What material is used for dies for die-casting aluminum? Are there any special precautions to be observed in making and using these dies?

Answered by Jacob H. Smit, Newark, N. J.

Usually an alloy steel of great heat-resisting qualities is used for making dies for die-casting aluminum. As the melting point of aluminum alloys is approximately 1150 degrees F., trouble may be encountered in the form of checking in the mold cavities if such a steel is not used.

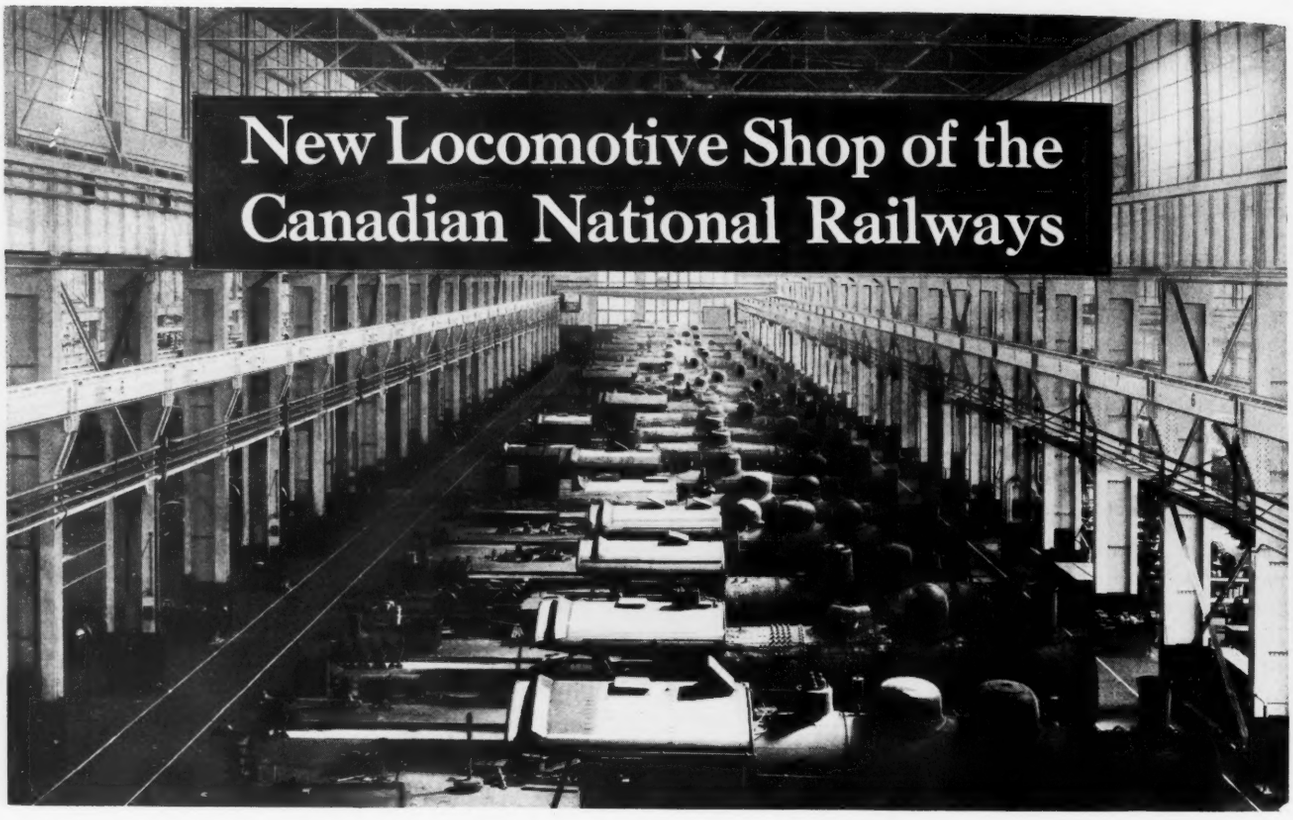
Tungsten hot die steel has been found to stand up very satisfactorily in this service; the low percentage of carbon in this steel gives it great toughness, while the tungsten has the ability to resist the high heat. In hardening, the dies should be heated to 1800 degrees F. and quenched in oil, after which they should be drawn to a temperature of 1100 degrees F. This should produce a Brinell hardness of 350 to 450.

In constructing the dies, under-cuts should be avoided so that the casting can be ejected easily. The minimum wall thickness that can be cast is about 1/16 inch on castings of small size and 1/8 inch on comparatively large castings. On the side walls a draft of 0.005 inch has been used with good results. Cores under 1 inch should have a draft of about 0.015 inch per inch of length, although less draft can be used on larger cores.

About the smallest hole that can be cast in aluminum is 3/32 inch in diameter, while the finest external thread is 20 per inch. Compensation should be made for the shrinkage that is bound to occur on aluminum castings. This shrinkage is approximately 0.014 inch per inch of length, and this should be allowed for in making the dies.

Before the molds are used, the mold cavities should be swabbed with acid. This will produce a brown film and will also tend to prevent any fusion of the molten metal and the mold. Before beginning operations, the dies should be heated, as otherwise flow lines will show on the finished casting. The molten metal should not be too hot, as excessive shrinkage will result when it comes in contact with the cooler mold and will leave surface blisters and "pipes."

[See also "Making Molds for Die Casting" in February, 1927, MACHINERY.]



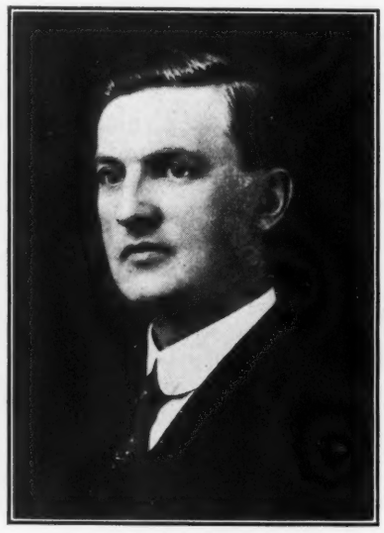
New Locomotive Shop of the Canadian National Railways

A Railroad Shop Recently Completed at Montreal that Embodies in its Design Many Unique Features not Generally Found in Locomotive Shops

By JOHN ROBERTS, General Supervisor of Shop Methods, Canadian National Railways

THE Canadian National Railways recently placed in operation a new locomotive shop at Point St. Charles, Montreal. The design of the new shop is unusual in many ways and does not correspond to that of any other railroad shop now in existence. The total length of the shop is 1056 feet, and the total width, 265 feet. It consists of an erecting shop, machine shop, tender shop, boiler shop, and blacksmith shop, in addition to a thoroughly modern and unusually well equipped power plant.

The erecting shop, a view of which is shown in the heading illustration, has thirty-four pits, the bays being on 24-foot centers. The length of this shop is 755 feet, its width, 85 feet, and its height, 56 feet to the roof truss. This shop is served by a 200-ton overhead crane equipped with a 10-ton auxiliary crane. Two 15-ton overhead cranes are also provided. The erecting shop is designed with an additional bay in front of the locomotive pits, so that all front end work, such as boiler tubes, superheater equipment, feedwater heaters, front end doors and rings, air brake work, etc., can be repaired and rebuilt in this department. This bay is 659 feet long, 55 feet wide, and 35 feet high to the roof truss. It is served by a 15-ton overhead crane.



John Roberts

Arrangement of the Machine Shop

The machine shop consists of two bays, one for heavy machining and one for light, both running parallel with the erecting shop. The heavy machine shop bay is 659 feet long, 70 feet wide, and 35 feet high to the roof truss, and is served by two 15-ton overhead cranes. The light machine shop bay is of the same length and height, but 55 feet wide. The shop is equipped with up-to-date machine tools, and it might be of interest to note that the Canadian National Railways have adopted many new developments, such as the grinding of locomotive journals and crankpins. A special machine has been built by the company for this purpose. An electric furnace is also provided for heating locomotive and truck tires, and three electric wall cranes facilitate the work in the light machine shop.

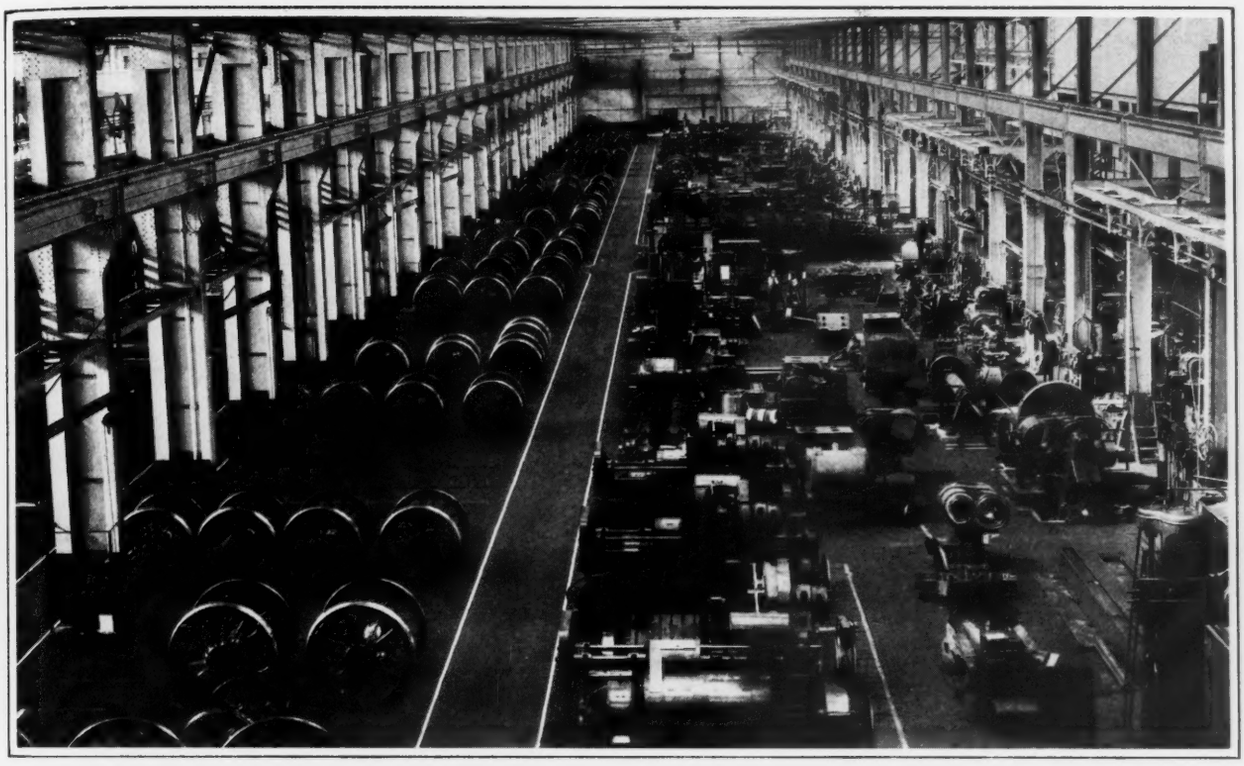


Fig. 1. Main Machine Shop Bay of the New Canadian National Railways Shop in Montreal

The machine tools are arranged, where possible, for individual motor drive. The main feeders are brought over from the switchboard in the power plant in a tiled conduit under ground, and two runs of tiled conduit under the floor carry the feeders through the length of the shop. Service switches are placed throughout the shop, and fed from the main feeders. From the service switches the machine tools are wired through iron conduit, which is run through the concrete floor slab. Lead-covered two- and three-conductor cable is used for all the mains and motor wiring—paper insulation for the larger sizes, and rubber for the smaller.

A comparatively large proportion of steel sash glazed with rough cast glass, together with the skylights, gives exceptionally good natural lighting. The artificial lighting system consists of Holophane reflectors with 750 and 500 watt lamps. The building is painted with aluminum paint. The floors in the main buildings are of cement, covered with creosoted red pine blocks, except the blacksmith shop and spring shop, which have cinder floors with

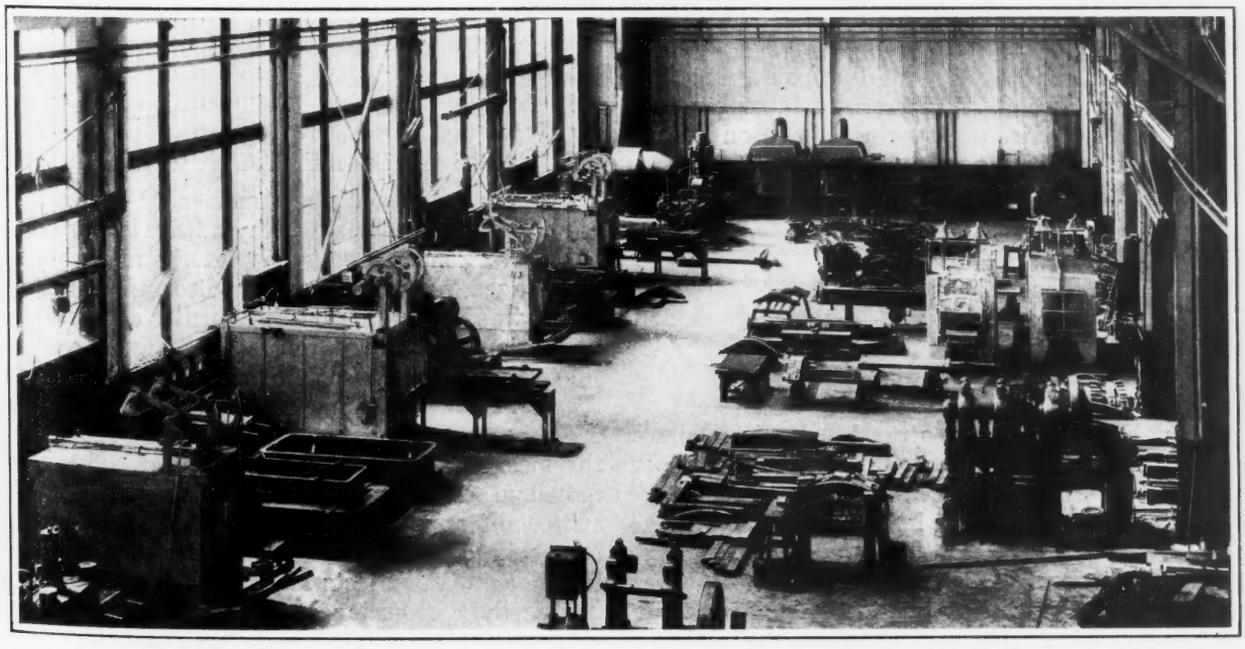


Fig. 2. Spring Shop, Showing Electric Furnaces and Spring-forming Presses

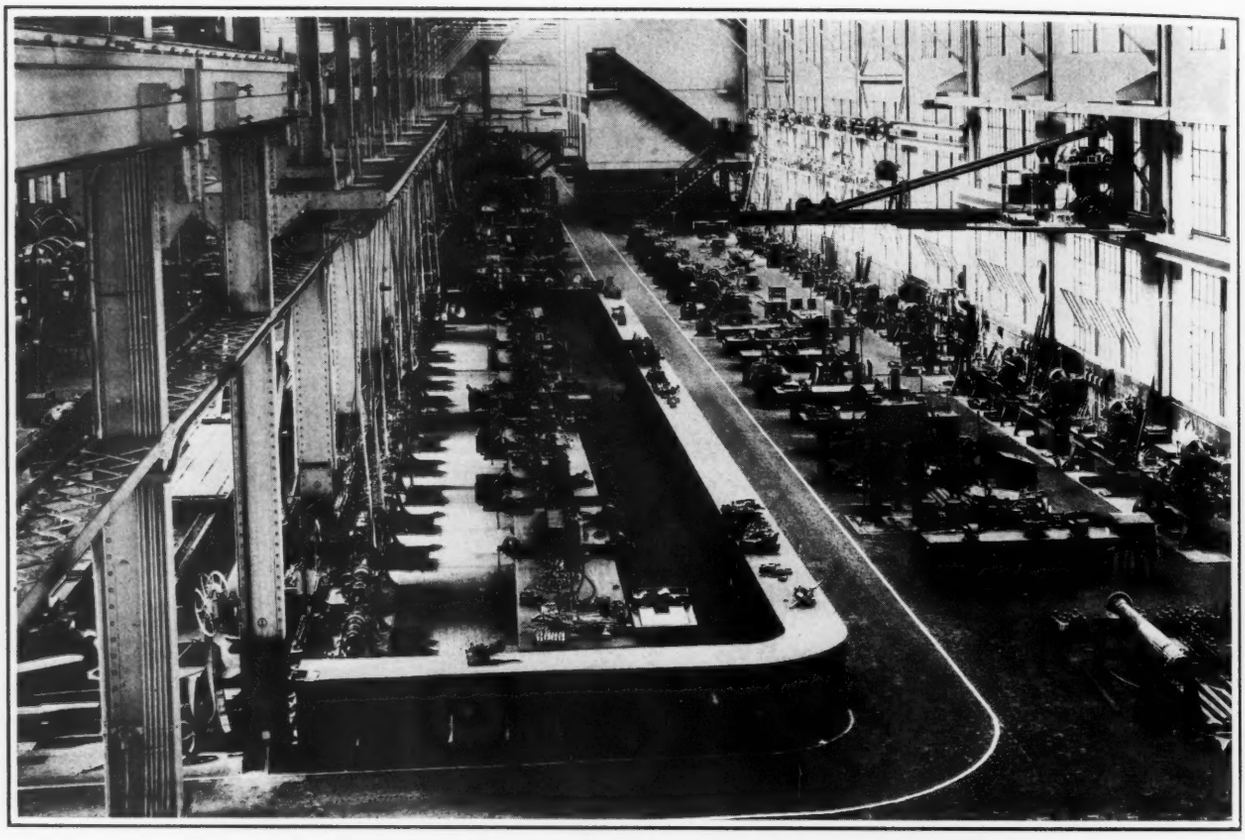


Fig. 3. The Light Machine Shop Bay in the Canadian National Railways Shop

cement truck runways. The floor in the tender shop is of cement with a metallic hardened surface.

The pipe work throughout the entire shop is welded, and a pipe coloring scheme is employed as follows: Acetylene, bright red; gasoline, orange vermillion; city gas, dark red; air lines, dark lead; oxygen, pea green; live steam, bright yellow; exhaust steam, light brown; vacuum lines, dark drab; oil lines, black; drinking water, white; hydraulic pressure lines, light blue; washout lines, dark blue; plant water, plain green; and electric conduits, aluminum.

The shop is arranged with four incoming and four outgoing tracks, and locomotives coming into the shops for repairs are stripped down on the incoming tracks, which are surrounded by four large cleaning vats and two tender inspection pits.

The Spring Shop and its Heat-Treating Equipment

The spring shop is 130 feet long by 54 feet wide. All the furnaces for heat-treating spring stock and for heating buckles are of the electric type. Furnaces of the direct-heat type are used for drawing the springs after quenching, which is a special feature, as this operation is often handled elsewhere by means of a salt bath. Automatic heat control is employed for every furnace, and recording pyrometers are supplied both for heat-treating and drawing furnaces.

The boiler shop is 216 feet long, 85 feet wide, and 56 feet high to the bottom of the roof truss. It is equipped with a 40-ton overhead electric crane, which operates on the same runways as the 200-ton crane in the erecting shop and is capable of passing from the boiler shop through the entire erecting shop. The two 15-ton cranes can also run through the boiler shop, an arrangement which makes this part of the shop very flexible. The second bay in the boiler shop, where the light boiler work is done, is served by a 15-ton crane, which also operates on a continuation of the runway from the erecting shop.

The power plant is as well equipped as the shops. It is unusually well ventilated and lighted, with white walls and white tiling extending 5 feet above the floor.

* * *

FOUNDRYMEN'S MEETING AND EXHIBITION

The convention of the American Foundrymen's Association in Cleveland, May 12 to 16, was unusually well attended, and a very interesting exhibition was staged in the Cleveland Auditorium. The attendance was larger than at any former convention or exhibition, and both the number of exhibitors and the floor space occupied by the exhibits exceeded the former record, made in Detroit in 1926.

Technical sessions were held during each day of the meeting, covering every phase of the foundry industry. A great deal of attention was given to the subject of apprentice training, two important papers being presented on this topic. The men who teach foundry subjects at engineering schools met during the convention at the Annual Foundry Instructors' Dinner. This event has become a regular feature of the convention.

Problems of the Machine Tool Industry

The National Machine Tool Builders' Association at its Spring Meeting Discussed Many of the Important Aspects of the Industry

IN his address before the twenty-eighth spring convention, the president of the National Machine Tool Builders' Association, Carl A. Johnson, president of the Gisholt Machine Co., briefly referred to the development of the Association. He pointed out how the Association has become one of the outstanding trade associations of the country, and how its work to establish better trade practices, its efforts in promoting sound cost accounting, and its pioneering in many other fields of trade association activities, have been of assistance to other trade organizations in their work. The cooperation with other societies and associations engaged in building and distributing machinery has actually been a public service.

The general manager, Ernest F. DuBrul, dealt in his report with many of the important problems of the Association. He reviewed the general business conditions and pointed out that it seems probable that as soon as business confidence takes a turn, there will be a marked revival in orders for machine tool equipment.

Can the Operation of Industry be Made More Stable?

"Bearing on the matter of stabilization," said Mr. DuBrul, "are some interesting facts based on the census of manufactures of 1927. The figures show that 4 per cent of the total establishments make 68 per cent of the total product, and employ about 58 per cent of the wage earners.

"In 1927, eight counties in the United States worked up one-fourth of all the materials used in manufacturing, with thirty-three more counties accounting for the next fourth, so that forty-one counties used half of all the material used in manufacturing that year. When the counties in question are grouped together with a few other adjoining counties added to them, it becomes evident that considerably over half of the manufacturing in the United States is concentrated in sixteen well defined manufacturing centers. The wage earners employed are also concentrated in these centers. This means that the effects of irregularity of operation in manufacturing industries are most marked in a very few regions, due to this concentration of manufacturing establishments.

"Irregularity in employment is being discussed in all quarters," said Mr. DuBrul. "As most of this irregularity is due to the large establishments which employ so large a proportion of the wage earners, the problem of stabilizing employment rests mostly with the managers of relatively few companies."

The machine tool industry is much interested in this problem of general stabilization, because it cannot stabilize its production unless its customers stabilize their demand for machine tools. For ten years the average demand was less than half the peak load demand during part of 1929. The industry had to build up a force to the peak load capacity, to take care of its customers' orders for a short period. Then it had to lay off many of these men when demand fell off. It is very troublesome and very costly to have such irregular operation in an industry requiring the kind of skilled labor that the machine tool industry requires. About the only thing that the industry can do is to keep calling this situation to the attention of its customers, urging them to do their replacing of old equipment in times of dullness rather than in times of boom.

Reducing the Cost of Selling Industrial Products

At the dinner of the convention, Edward J. Mehren, vice-president of the McGraw-Hill Publishing Co., Inc., spoke on industrial marketing. He mentioned that the market for industrial products —products sold by one industry to another, as distinct from consumer goods—amounts to $35,000,000,000 annually in the United States. A new attitude toward marketing costs is apparent; it is becoming recognized that there is a great waste in methods of distribution.

Some twenty-five years ago, definite efforts were beginning to be made to eliminate waste in production methods and to reduce production costs. These efforts have been even greater since the war. As a result, production costs, expressed in dollars and cents, have not increased since 1913, for the industry as a whole, and in some instances they have decreased, in spite of increased wages and overhead costs; but sales costs have increased.

The reason is, according to the speaker, that we have studied production more thoroughly than we have distribution. We have more data on production costs than on sales costs. We must pay more attention to sales costs; we must break up the sales expense into its elements, as we have production costs, and then direct sales efforts into the channels where the greatest results are obtainable with the least expense.

Mr. Mehren also emphasized the need for designers to study thoroughly the requirements of the industry's customers in their own shops—to be in close touch with the methods in the plants of the users of machine shop equipment.

German Machine Tool Developments

A review of German machine tools exhibited at the Leipzig Fair was given by D. B. Burleigh of the Sundstrand Machine Tool Co., Rockford, Ill. Mr. Burleigh called attention to the great advance made by German machine tool builders in recent years. At Leipzig, many new designs were in evidence. Hydraulic feed and speed mechanisms were com-

monly employed; automatic lubrication was applied to a great many machines; and the electric motor applications were especially noteworthy, because of the pleasing appearance of the complete machine and motor unit. The grinding of ways and other flat bearing surfaces is common practice in German machine tool building plants. Several other members of the Association who have recently visited Germany also gave some interesting information relating to the present development of the German machine tool industry.

"The International Engineering Congress in Japan" was the subject of addresses by Wilson P. Hunt, president of the Moline Tool Co., Moline, Ill., and H. M. Lucas, president of the Lucas Machine Tool Co., Cleveland, Ohio. Both speakers referred to the rapid development of the Japanese industries and the present status of machine tool building in Japan.

A number of committee reports were presented to the convention covering, among other subjects, the present status of time selling in the machine tool industry, contract forms for machine tool agencies, recommendations of standard clauses for sales proposals, and plans for the next machine tool exposition, which will be held in Cleveland, September 10 to 17, 1932.

A study of statistics as presented by Ernest F. DuBrul in his answer to the question "What is Normal Operation?" indicates that 65 per cent of one-shift capacity is a fair basis for calculating normal operation in the machine tool industry.

A discussion on the subject "What is a Machine Tool?" was opened by Ralph E. Flanders, manager of the Jones & Lamson Machine Co., Springfield, Vt. This question is of considerable importance since the exhibition of machine tools at the expositions of the Association is confined to members, and membership is confined to the builders of machine tools. Decision on the definitions proposed was deferred.

Exports of American Metal-working Machinery

	1925	1926	1927	1928	1929
Canada	$2,328,400	$3,214,770	$4,626,481	$6,937,761	$8,374,795
United Kingdom	4,053,267	4,654,007	5,721,064	6,345,090	8,282,078
France	2,429,269	1,581,929	2,198,424	4,690,227	6,367,240
Soviet Russia in Europe	887,923	537,931	1,046,465	1,193,388	2,619,658
Germany	2,986,434	1,017,824	3,175,313	2,615,427	2,134,327
Japan	1,204,733	874,491	1,238,320	1,424,664	1,686,238
Italy	1,724,504	515,165	598,786	876,730	1,497,190
Sweden	301,862	329,776	386,037	535,847	1,120,477
Belgium	183,792	266,408	291,183	947,494	762,511
Czecho-slovakia	256,832	107,127	156,425	801,761	658,439
Netherlands	365,103	109,981	296,789	460,377	623,550
Mexico	557,106	637,964	335,760	540,895	603,688
Australia	840,796	918,295	939,858	669,279	580,896
Argentina	324,803	252,148	406,865	524,694	547,993
Brazil	299,458	383,243	567,543	649,160	463,981
Spain	323,135	228,633	361,801	307,975	453,061
British India	361,576	460,951	396,905	310,102	444,899
Chile	485,160	418,926	209,907	206,274	427,179
Netherlands East Indies	85,374	95,918	123,667	245,880	375,076
British South Africa	268,791	323,506	288,668	317,604	349,900
Switzerland	66,482	107,822	157,069	136,469	233,230
Venezuela	127,564	177,699	246,418	164,152	158,804
Cuba	309,160	209,386	201,477	132,503	157,755
Philippine Islands	53,309	72,846	114,302	123,033	140,155
China	46,055	61,900	42,131	48,584	124,771
Peru	81,718	202,189	133,960	120,844	123,195
Colombia	243,818	139,485	218,055	136,579	105,996
New Zealand	87,510	240,733	155,855	118,483	95,259
Denmark	21,634	28,708	43,281	80,767	88,315
Panama	70,056	33,593	42,412	100,527	87,996
Poland and Danzig	20,144	42,086	36,683	76,876	87,114
Norway	45,838	30,388	39,010	83,742	83,719
Bolivia	19,991	21,840	20,519	73,480	73,580
Irish Free State	*	*	*	1,159,893	69,958
Uruguay	27,576	15,356	13,553	36,872	57,793
Netherlands West Indies	*	*	*	123,569	55,512
Finland	*	*	*	67,857	52,891
British Malaya	20,701	22,728	20,715	39,813	52,837
Soviet Russia in Asia	*	*	*	150,177	51,963
Total, including other countries	$22,036,796	$18,867,522	$23,379,417	$34,126,809	$40,803,393

*Included in "other countries"

PROTECTIVE COATINGS FOR PIPE

Because of the importance to the gas industry of protection of underground pipe, the American Gas Association has appropriated funds for a study of this subject and has appointed a research associate at the Bureau of Standards. The object of the research is to determine the characteristics and properties of various covering materials with a view to obtaining one that will furnish the best protection for pipe at a reasonable expense. According to information received from Germany, remarkable developments have been made there in the solution of the problem of covering pipe with a coating that is resistant to acids and atmospheric conditions.

Warner & Swasey Co. Celebrates Fiftieth Anniversary

This is a year of many anniversary celebrations of engineering societies and manufacturing companies. One of the well-known machine tool-building concerns, The Warner & Swasey Co., Cleveland, Ohio, celebrates its fiftieth anniversary this year, the firm having been founded May 5, 1880 through the partnership of Worcester R. Warner and Ambrose Swasey. For twenty years the firm continued as a partnership until, in 1900, it was incorporated as The Warner & Swasey Co.

Mr. Warner passed away last summer, while Mr. Swasey is taking an active part in commemorating the firm's fifty years in business. Nothing could indicate the characteristics of the two men more plainly than the fact that for twenty years they were partners, but there never was a written word to confirm the partnership.

Ambrose Swasey and Worcester R. Warner (Seated) with their Business Associates in 1880 (Standing, Left to Right), William S. Lane, George C. Bardons, George D. Phelps, and Frank H. Woods

Mr. Warner and Mr. Swasey were friends and associates from their early youth. Before they were twenty years old they met as fellow apprentices at the Exeter Machine Works, Exeter, N. H., and in 1870, when both were twenty-four years of age, they entered the employ of the Pratt & Whitney Co., Hartford, Conn., where Mr. Warner soon was put in charge of one of the assembly floors and Mr. Swasey became foreman of the gear-cutting department.

In 1880, they left the Pratt & Whitney Co. to embark on their great adventure—going into business together. They first established themselves in Chicago, but discovered that they had gone too far West for that early period in machine tool building, and in 1881, they moved to Cleveland, Ohio, where they built a shop on the very site on which The Warner & Swasey Co.'s plant today is located.

The new company soon became known as a builder of high-grade machine tools and special machinery, and, owing to Mr. Warner's interest in astronomy, it also became known for the design and construction of telescopes and other instruments for observatories; but at the same time that the building of great astronomical instruments attracted world-wide attention, the company became equally well known in the mechanical field as the builder of a complete line of turret lathes—in fact, turret lathes have always formed the solid base upon which the company's success has rested.

Nearly twenty years ago the partners gradually began to withdraw from the active management of the business they had founded, turning over the work to younger minds. The names of Frank A. Scott, who for many years was president and active directing executive of the organization, and of Philip E. Bliss, now president, are well known throughout the mechanical industries.

The growth of The Warner & Swasey Co. has been coincident with the greatest mechanical development in the world's history. Primitive methods of machining in vogue at the time of the founding of the company, especially in the brass industry, provided an excellent opportunity for the introduction of the turret lathe. As is frequently the case, the interest of the founders in the early days was almost wholly in the building of good machine tools; their interest in selling was altogether subordinate to that main idea, but it is on the reputation for high quality and accuracy which was early established that the company has developed its present selling plan.

About 1900, new conditions began to present themselves in the manufacturing industries, and in the period between 1900 and the beginning of the World War the methods of selling machine tools underwent a fundamental change. Instead of selling through machinery dealer organizations, the company began to develop direct selling methods, especially after 1909, when Frank A. Scott became manager.

The Warner & Swasey Co. was one of the first to recognize the value of factory trained specialists. Young men were selected to represent the company in the field, and these men were given a practical schooling in the shop to make them thoroughly familiar with the design, construction, and application of the equipment being built. With the growth and development of the automobile industry, the problem of selling turret lathes changed quickly from that of a pure selling problem to what is now known as sales engineering. An organization of thirty salesmen, coordinated with a corps of service men and an adequate sales engineering department, has been the result of this development. Twelve district offices of the company are now located in the important metal-working centers of the country, and factory trained representatives are also available in foreign countries.

Are Precision Machines Sound Investments?

A Detailed Analysis of a Number of Jobs Actually Handled in One Shop Answers this Question in the Affirmative

By H. A. LAYSTROM, Quality Hardware & Machine Corporation

THE practice of buying machine tools on the "cost per piece produced" basis is becoming more general, and today the larger concerns, especially, often purchase very expensive machines for ordinary work, because they have found by experience or by careful investigation that the seemingly high initial costs are more than balanced by the ultimate savings in production costs. However, many manufacturers dismiss the thought of purchasing a precision dividing engine or jig boring machine, for example, simply because they believe that they have not a sufficient amount of precision work to keep the machine regularly employed. They do not realize that the work for which it is most urgently needed may prove to be but a very small part of the work on which the so-called precision machine will show substantial savings.

The experience of the Quality Hardware & Machine Corporation, Chicago, Ill., who purchased a jig boring machine a little over a year ago, should be of interest to manufacturers having a limited volume of work for a precision type machine. In this particular case, the machine was obtained for jobbing shop work, which included the manufacture of dies, milling fixtures, gages, special machines, and light manufacturing work, a specialty being made of jobs requiring a high degree of accuracy. The machine was one made by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, represented in this country by the R. Y. Ferner Co., Washington, D. C.

To determine the savings actually resulting from the purchase of this machine, the A. C. Nielsen Co., in collaboration with the writer, conducted a survey covering three jobs handled on the machine.

The first of the three jobs consisted of boring eight holes in a piercing die-block of tool steel. This block was 3 inches by 9 inches by 1 1/8 inches. Four of the holes were 1 inch in diameter and four were 3/16 inch in diameter. These holes were unevenly spaced and had to be held to limits of 0.0005 inch on their diameters and also on the spacing. The time required for the job was as follows:

Operation	Time Hours	Time Min.
Read drawing and convert measurements to additive dimensions	—	30
Mount work on table and set machine	—	10
Center-drill the holes	—	20
Drill holes to within a few thousandths of required size	—	45
Ream holes	1	30
Total time	3	15

The nearest approach to this time previously obtained by the button method was 9 hours 30 minutes. Thus the saving with the jig boring machine was 6 hours 15 minutes.

The second job consisted of boring five holes in a circular die of tool steel 6 1/2 inches in diameter by 2 inches thick. Two holes 0.710 inch in diameter were counterbored to a diameter of 1 1/2 inches for a depth of 9/16 inch. Two other holes were bored to a diameter of 0.295 inch, while the fifth hole was bored to a diameter of 0.759 inch. These holes were spaced irregularly in such a manner that the lay-out by hand would have been rather difficult. The limits set for this work were 0.0005 inch for the position of the holes and the same limits were set on the diameters. The time for each operation on this job was as follows:

Operation	Time Hours	Time Min.
Read drawing and convert to additive dimensions	—	30
Mount work on table and set the machine	—	10
Center-drill the holes	—	30
Drill to within a few thousandths of required size	1	—
Ream holes	3	—
Counterbore as specified	2	30
Total time	7	40

This time represented a saving of 7 hours 5 minutes over the usual button method.

The third job consisted of boring sixty-three irregularly spaced holes in a plate 52 inches long, 18 inches wide, and 1/2 inch thick. The plate was so long that it overhung the table of the jig boring machine and required three set-ups. Half of the holes were reamed to a diameter of 7/16 inch, and the remaining holes were reamed to five different sizes, ranging from 1/4 to 5/8 inch in diameter. The spacing between the holes had to be held to a tolerance of 0.001 inch, and the tolerance on the diameters was 0.0005 inch. The total time required was 12 hours 45 minutes, compared with a total time of 106 hours for the usual button method.

The average time ratio obtained by the present and former jig boring methods, on the three jobs mentioned, together with two others of similar nature is 1 to 6.48. In other words, one hour of time on the jig borer, costing $1.24 per hour, is worth 6.48 hours of time spent using the button method, which was worth $1.18 per hour, or $7.65 for 6.48 hours. The net saving per hour of operation on the jig borer is thus $6.41, and the net annual saving in a 285-day working year, averaging 7.2 hours per day, is $13,153.32.

It is believed that these examples conclusively answer the question "Are Precision Machines Sound Investments?"

MACHINERY'S DATA SHEETS 179 and 180

PRACTICE IN THE USE OF CUTTING FLUIDS—1

Data from Seventy-five Plants where Large Quantities of Cutting Fluids are Used. This Table Gives the Number of Users for Each Class of Fluid, and Applies to Heavy or Roughing Cuts; Similar Data for Light Finishing Cuts Showed About the Same Practice

Machining Operation	Low-carbon Steel					High-carbon Steel				
	Dry Cutting, Including Air Blast	Water or Emulsions		Oils, Oil Mixtures, etc.		Dry Cutting, Including Air Blast	Water or Emulsions		Oils, Oil Mixtures, etc.	
		Number of Plants Using	Fluids Most Used*	Number of Plants Using	Fluids Most Used*		Number of Plants Using	Fluids Most Used*	Number of Plants Using	Fluids Most Used*
Turning	17	27	13-M	19	7-P, 5-S	17	21	9-M	20	7-S, 5-P
Boring	15	27	12-M	16	6-P, 6-S	14	21	8-M	18	7-S, 5-P
Drilling	2	50	23-M	23	9-P, 4-S	2	36	16-M	25	6-P, 6-S, 5-N
Reaming	3	26	15-M	40	12-P, 9-U, 8-N	2	20	11-M	36	8-N, 8-P, 6-S
Threading	1	18	7-M	57	15-P, 11-N	2	7	2-M	50	13-N, 12-P
Tapping	0	11	6-M	61	20-P, 10-N	2	3	2-M	52	13-P, 10-N, 9-U
Milling	1	40	14-M	24	8-P	2	30	14-M	28	7-N, 6-P
Shaping	31	1	1-J	4	2-P	29	0	....	4	1-N, 1-P, 1-S
Planing	34	2	1-E, 1-M	4	2-P	29	0	....	4	2-P
Gear Cutting	1	10	6-M	40	12-P, 8-S	1	9	5-M	33	8-P, 7-S, 6-U
"Automatics"	0	4	1-F, 1-J	51	16-P, 10-U, 8-N	0	4	1-F, 1-J	45	13-P, 10-U, 7-S
Turret Lathes	1	29	15-M	35	20-P	0	21	15-M	31	20-P
Slotting	13	10	4-M	21	9-P	13	7	3-M	19	6-P, 4-N, 4-S
Broaching	2	7	5-M	35	12-P, 11-N	1	6	5-M	29	10-N, 7-P, 6-S
Cutting off	2	18	10-M	32	15-P	3	17	8-M	28	12-P
Cold Sawing	4	32	17-M	27	10-P	4	27	16-M	24	9-P
Grinding	4	56	17-E, 14-M	2	1-P	4	57	16-M, 15-E	1	....
Lapping	1	1	1-J	17	6-P, 3-U, 3-W	1	2	1-J, 1-M	21	6-P, 6-U

*The numbers in columns headed "Fluids Most Used" represent the number of plants, and the letters, classes of fluids used, as shown by the following key:

E = Water + alkali
F = Water + alkali + fatty oil
J = Water + fatty oil + mineral oil
M = Water + mineral oil + soap
N = Fatty oil
P = Fatty oil + mineral oil
S = Fatty oil + mineral oil + sulphur
U = Mineral oil
W = Kerosene

Data from paper on "Present Practice in the Use of Cutting Fluids," by S. A. McKee, presented at the annual meeting of the American Society of Mechanical Engineers, December, 1929.

MACHINERY'S Data Sheet No. 179, New Series, June, 1930

PRACTICE IN THE USE OF CUTTING FLUIDS—2

Data from Seventy-five Plants where Large Quantities of Cutting Fluids are Used. This Table Gives the Number of Users for Each Class of Fluid, and Applies to Heavy or Roughing Cuts; Similar Data for Light Finishing Cuts Showed About the Same Practice

Machining Operation	Cast Steel					Alloy Steel				
	Dry Cutting, Including Air Blast	Water or Emulsions		Oils, Oil Mixtures, etc.		Dry Cutting, Including Air Blast	Water or Emulsions		Oils, Oil Mixtures, etc.	
		Number of Plants Using	Fluids Most Used*	Number of Plants Using	Fluids Most Used*		Number of Plants Using	Fluids Most Used*	Number of Plants Using	Fluids Most Used*
Turning	17	21	11-M	14	4-P, 4-S	15	21	11-M	27	8-S, 6-P, 4-N
Boring	18	22	11-M	14	5-S, 4-P	11	17	9-M	25	7-P, 6-S, 4-U
Drilling	1	41	19-M	18	4-P, 4-S, 3-U	1	30	16-M	31	7-S, 6-P, 4-N
Reaming	2	22	12-M	33	10-P, 9-N	2	14	10-M	38	9-P, 6-S, 5-N
Threading	1	13	5-M	41	11-P, 9-N	0	9	3-M	49	10-N, 10-P, 9-S
Tapping	0	8	4-M	49	15-P, 9-N	0	4	3-M	55	15-P, 9-N, 8-S
Milling	2	31	17-M	17	5-P	0	29	15-M	27	7-P, 4-N, 4-S
Shaping	29	1	1-J	3	1-P	28	0	....	4	1-P, 1-S, 1-T
Planing	31	1	1-J	3	1-P	32	0	....	5	1-P, 1-R, 1-S
Gear Cutting	2	9	5-M	24	6-P, 4-N, 4-U	0	8	4-M	29	7-P, 5-N, 5-S
"Automatics"	0	2	1-F	25	10-P	0	4	2-M, 1-F	42	9-P, 8-N, 7-S
Turret Lathes	1	18	9-M	23	13-P	0	16	9-M	32	12-P
Slotting	11	7	3-M	19	8-P	12	7	4-M	21	9-P
Broaching	2	6	5-M	22	9-N, 5-P	1	4	3-M	28	7-N, 7-P, 5-S
Cutting off	2	13	8-M	22	10-P	2	20	10-M	29	11-P, 6-S
Cold Sawing	2	22	11-M	18	7-P, 3-U	5	30	14-M	19	6-P, 4-S
Grinding	2	44	13-E, 9-M	1	.....	2	55	15-M, 13-E	1	.....
Lapping	1	1	1-J	13	4-P, 3-W	1	2	1-J, 1-M	17	5-P, 5-U, 3-W

*The numbers in columns headed "Fluids Most Used" represent the number of plants, and the letters, classes of fluids used, as shown by the following key:

E = Water + alkali
F = Water + alkali + fatty oil
J = Water + fatty oil + mineral oil
M = Water + mineral oil + soap
N = Fatty oil
P = Fatty oil + mineral oil
R = Fatty oil + mineral oil + kerosene + sulphur
S = Fatty oil + mineral oil + sulphur
T = Fatty oil + turpentine
U = Mineral oil
W = Kerosene

Data from paper on "Present Practice in the Use of Cutting Fluids," by S. A. McKee, presented at the annual meeting of the American Society of Mechanical Engineers, December, 1929.

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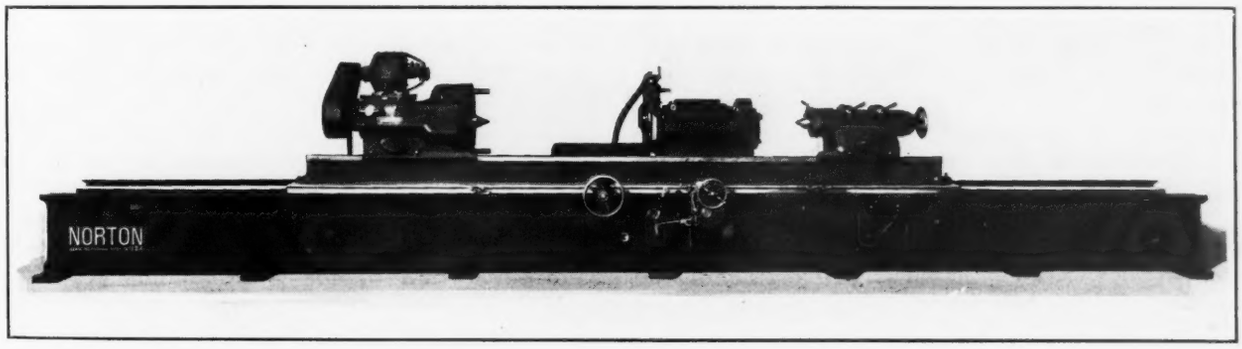
GRINDING ROLLS FOR COLD-ROLLING METAL

By HANS WICKSTROM, Norton Co., Worcester, Mass.

Manufacturers engaged in cold-rolling metals such as steel, nickel, gold, silver, platinum, zinc, brass, and foil are being called upon for new standards of quality with regard to uniformity of gage and character of finish. Such demands necessitate accurate grinding of the rolls. The Norton Co., Worcester, Mass., has worked closely with many of the rolling mills in an effort to satisfy their requirements. As a result, heavier machines have been designed and built to give greater accuracy than can be secured with equipment used for lighter work. Experiments conducted for the purpose of finding the most suitable grinding wheels have also led to the development of new types of wheels for producing the mirror-like surfaces required on the rolls.

One of the new Norton roll-grinding machines is shown in the accompanying illustration. This 28-inch Type D machine is built in lengths from 96 inches up. It incorporates several new features and improvements. The proportions of the base, the tables, and the wheel-slide are such as to insure rigidity. Other features are flood lubrication of the table ways and spindle bearing, and the application of multiple V-belts for driving the spindle.



Machine for Grinding Rolls for Cold-rolling Metal

On this machine it is possible to produce a quality of finish with less wheel changes than has been the custom in the past. The older practice was to rough-grind with a wheel not finer than 60 grain, using then 100 or 150 grain, followed by 200, and ultimately 400 or 500 grain for the final polish. Rolls of different kinds are finished in the new machine as follows:

Operations on New Rolls of Hardened Steel—(1) Rough-grind with a 46 DK Alundum vitrified wheel. (2) Semi-finish-grind with a 100 I Crystolon vitrified wheel. (3) Finish-grind with a 400-A Grade 1 Crystolon shellac wheel.

Operations on New Chilled Iron Rolls (Rough-turned)—(1) Rough-grind with a 36-B–T2 or T3 Alundum Bakelite wheel. (2) Finish-grind with the same wheel.

Operations in Regrinding Hardened Steel Rolls—(1) Rough-grind with a 100 I Crystolon vitrified wheel. (2) Finish-grind with a 400-A Grade 1 Crystolon shellac wheel.

Operations in Regrinding Chilled Iron Rolls—(1) Rough-grind with a 36-B–T2 or T3 Alundum Bakelite wheel. (2) Finish-grind with the same wheel.

The selection of wheels depends to a great extent on the size of the roll and its hardness. The foregoing tabulation, however, covers a fairly wide range of roll grinding requirements.

The following is typical of the rate of speed at which large rolls are finished. New chilled iron rolls, 24 inches in diameter by 30 inches long, were ground to a highly reflective finish, removing about 0.030 inch from the diameter, in a total of twenty-five hours. This includes the time required to produce a high finish on the necks and fillets as well as on the bodies. Formerly thirty-nine hours was required for this work and the finish was not so good as that now obtained.

* * *

GETTING READY FOR INCREASED BUSINESS

At the present time there seems to be a great deal of interest in new shop equipment. Many machine tool builders report very active inquiries, but the placing of orders is being delayed by the chief executives of many industrial corporations whose shop executives have planned important machinery replacement programs. This seems to indicate that we may again witness a great rush for machine tool equipment as soon as business begins to show greater activity. Buyers of shop equipment who are holding off placing orders are doubtless making a mistake in not getting their plants ready for the next increase in business, because, as has frequently been pointed out by leading executives in the machinery field, it is much more convenient and cheaper to replace equipment and rehabilitate the plant when business is quiet than to do so when work of that kind interferes with production in a period of active business. Yet many executives seem to overlook this fact.

* * *

The Polytechnic Institute of Brooklyn will celebrate its seventy-fifth anniversary June 17 and 18. This engineering school is one of the oldest American colleges of engineering, and is a pioneer in the establishment of college grade evening courses leading to a degree.

The British Metal-working Industries

From MACHINERY's Special Correspondent

London, May 17

There is but little change to report in the general position of the machine tool industry. Russia is reported to be taking a large number of machines for its agricultural implement shops. Shipments of machines to Australia are also increasing.

At the annual meeting ofthe Machine Tool Trades Association, a momentous decision was reached, namely, that members of the Association be permitted to exhibit machine tools, irrespective of the country of origin. Thus, at last, the ban placed on machines of German manufacture since the war at the exhibition held periodically at Olympia by the Machine Tool Trades Association has been removed; therefore in 1932 we may see a truly international display of machine tools.

In 1928, machine tools amounting to 8790 tons were imported into England, the total value being £1,404,059. Of these totals, Germany supplied nearly 47 per cent by weight and somewhat more than 31 per cent by value. This shows clearly that German machine tools do fill an important place in the requirements of manufacturers in the metal-working industries of Great Britain. The fact is that under existing conditions, these tools will continue to be imported whether they are admitted to the Olympia exhibition or not. Apart from some competitive lines, actually a large proportion of the German machine tool imports comprise machines that are required by manufacturers in various industries, but that cannot economically be manufactured in Great Britain.

With regard to the suggestion made by one of the members at the meeting to the effect that British manufacturers' prices were being undercut by foreign manufacturers, it was pointed out, that, according to the last returns issued by the Association, the importation of Swiss machine tools was at the price of £210 per ton, American £182, and German £142, whereas the exports from this country were at £131.

In the automobile industry, trade has improved during the last few weeks, and most firms are well employed, with a likelihood of a good volume of sales ahead. Small and medium class cars are in great demand. Last year the output of pleasure cars increased by 12 1/2 per cent, and up to the end of March this year the total value of cars and accessories was just over 2 1/2 million pounds, roughly the same amount as for the preceding year. Commercial vehicle manufacturers are well employed; the output last year increased 35 per cent.

March was a rather poor month for the export trade in machine tools. There was, however, a slight improvement in comparison with February. Although the total exports for the first three months were lower than for the corresponding period last year, they were higher than previous years.

Ajax Metal Co. Fifty Years Old

Among the numerous companies that are celebrating their fiftieth anniversary this year is the Ajax Metal Co., Philadelphia, Pa. This company was organized in 1880 to manufacture a new bearing alloy known as Ajax Metal, which was the first leaded-bronze bearing metal on the market. At first it was intended especially for railway requirements. It was developed and manufactured by Francis J. Clamer a few years prior to the incorporation of the Ajax Metal Co.

Before the advent of Ajax Metal, copper-tin alloys were generally used for bearings. The addition of lead to these alloys provided two essential bearing properties to a far greater degree than possessed by the older alloys — adjustability and surface oil retention, and increased wearing qualities at lower operating temperatures.

In 1896, while pursuing his course of study in chemistry at the University of Pennsylvania, G. H. Clamer, now president and general manager, was employed by the Ajax Metal Co. as chemist and has since directed its technical development. It is believed that Mr. Clamer was the first chemist employed regularly by any manufacturer in the non-ferrous alloy industry. He was, therefore, a pioneer in that field of industry, where today hundreds of chemists are employed and where chemical control is now a matter of daily routine.

In 1900, Mr. Clamer was awarded a patent covering the bearing alloy known as "Ajax Plastic Bronze." In 1902, the manufacture of manganese bronze was begun, and in 1916, the company brought out the Ajax-Wyatt electric melting furnace, of which now nearly 800 are in use in this country and abroad. This furnace is considered one of the greatest single developments in the brass industry during a long period of years. In these furnaces, over 10,000,000 pounds of brass are melted daily.

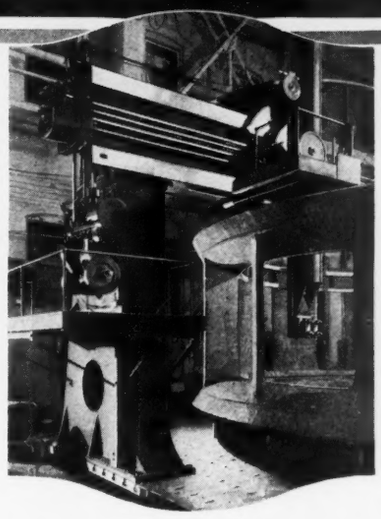
In 1917, this type of furnace was first applied to the production of the Ajax Metal Co.'s ingot metal. In 1920, the Ajax-Northrup oscillatory current furnace was developed—a most important laboratory research tool. In 1924, the company brought out what is known as the "seven-point" ingot, and in 1927, began the application on a commercial scale of high-frequency coreless induction furnaces. The company controls more than one hundred patents pertaining to this development alone.

New Shop Equipment

SELLERS 35-FOOT BORING AND TURNING MILL

A 35-foot boring and turning mill with removable cross-rail and uprights was recently built by William Sellers & Co., Inc., 1600 Hamilton St., Philadelphia, Pa., to meet the needs of the Newport News Shipbuilding & Dry Dock Co. The table is 19 feet 10 inches in diameter, and work up to 35 feet in diameter may be turned and bored with the cross-rail and uprights in place. By removing the cross-rail and uprights a large variety of work can be accommodated.

If the work consists of a ring larger than the table, it can be supported on outriggers clamped to the top of the table, as illustrated in Figs. 1 and 3, the table top extending 1/4 inch above the stationary floor plates. Larger work can be mounted on the floor plates and bored by means of a tool carriage fixed to the table. In such operations, tool movement is obtained by means of a star feed. For work of unusual



Latest Developments in Metal-working Machines, Small Tools, and Work-handling Appliances

size or character, the cross-rail and uprights are removed. In that case, either the table carries the work and the tool carriages are mounted on the floor plate or else a tool carriage is revolved within the fixed work, according to the requirements.

The bed, table, and driving mechanism are similar in construction to those of the standard boring and turning mills built by the company. The table is supported on two flat annular bearings on the bed, as will be apparent from Fig. 2. A spindle 3 feet long by 20 inches in diameter, ground to a taper, extends downward into the bed and fits into a bushing which is adjustable vertically to take up lost motion. The table is driven by a spur gear having a pitch diameter of 16 feet and a circular pitch of 3.770 inches.

A 50-horsepower motor having speeds of from 400 to 1600 revolutions per minute drives the table through a gear train having four speed changes. This entire mechanism is located below the floor plates, where it is protected from dust and dirt. A motor-driven pump supplies oil under pressure to the annular table bearings and all bearings and gears in the driving train.

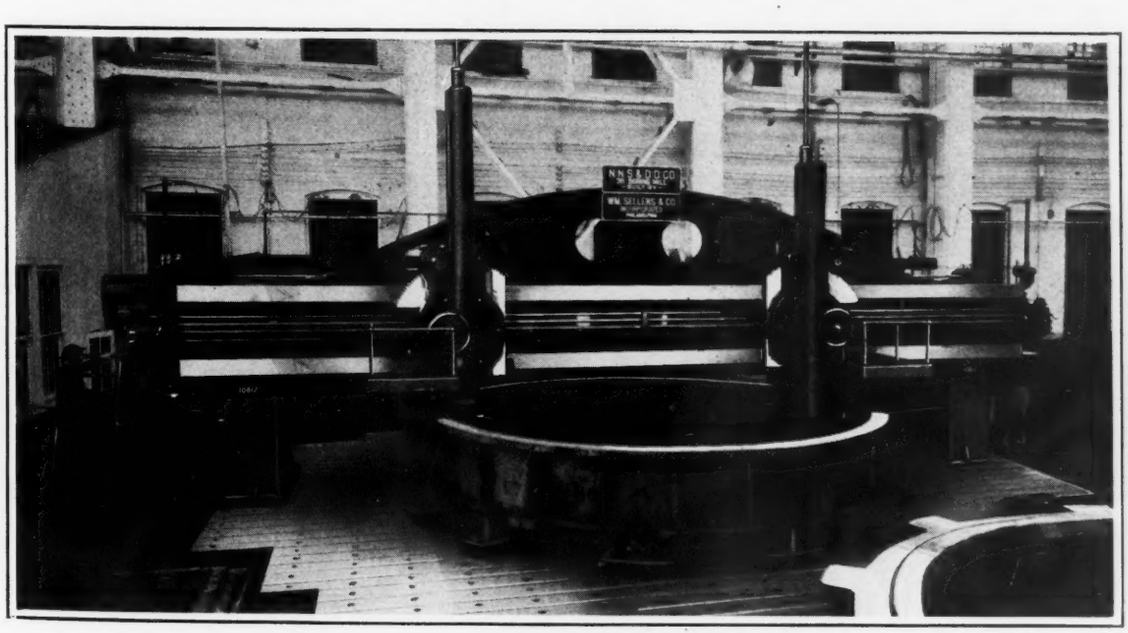


Fig. 1. Sellers 35-foot Boring and Turning Mill with Removable Uprights and Cross-rail

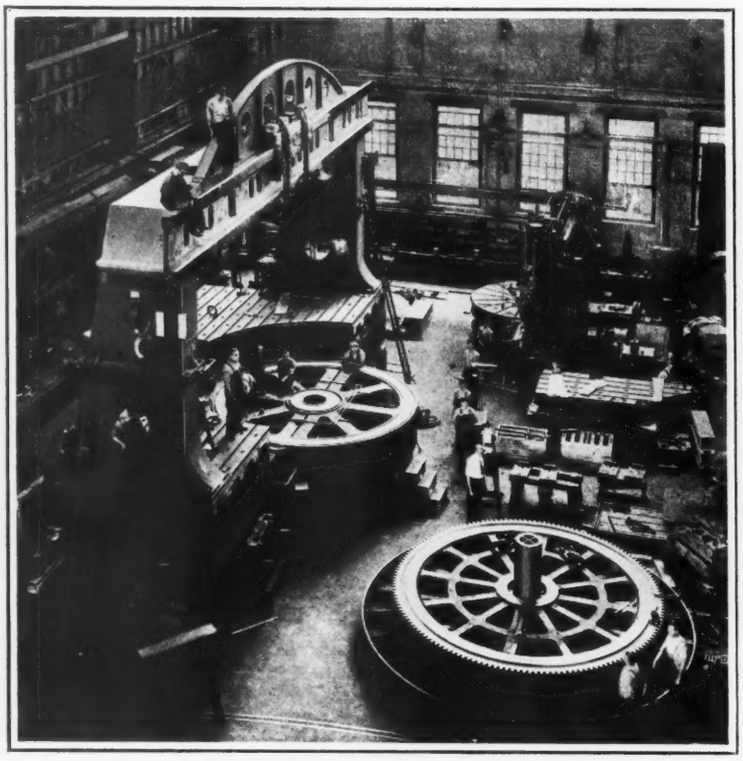


Fig. 2. View Showing Under Side of Table in Foreground and the Partially Erected Machine, where the Annular Bearings on which the Table is Supported may be seen

The cross-rail is of a deep box-girder design, has a 48-inch face, measures 5 feet from front to back, and is 42 feet long. A stiffening beam on top of the cross-rail makes the actual vertical height of the rail from bottom to top, 8 feet 10 inches. This beam counteracts any tendency for the cross-rail to be deflected downward. Two saddles are provided on the cross-rail having rams with a stroke of 10 feet. However, the machine has been used with an 18-inch extension on the rams at the bottom of the stroke.

As shown in Figs. 2 and 3, the uprights consist of two sections. They are not designed to permit vertical movements of the cross-rail, but to hold it at a fixed height from the table. With only one section in place, as shown in Fig. 1, the cross-rail is 7 feet above the table, whereas with two sections the height is 13 feet. Other upright sections can be added to further increase the height. Large eye-bolts are provided at each end of the cross-rail for conveniently lifting it with the uprights in place.

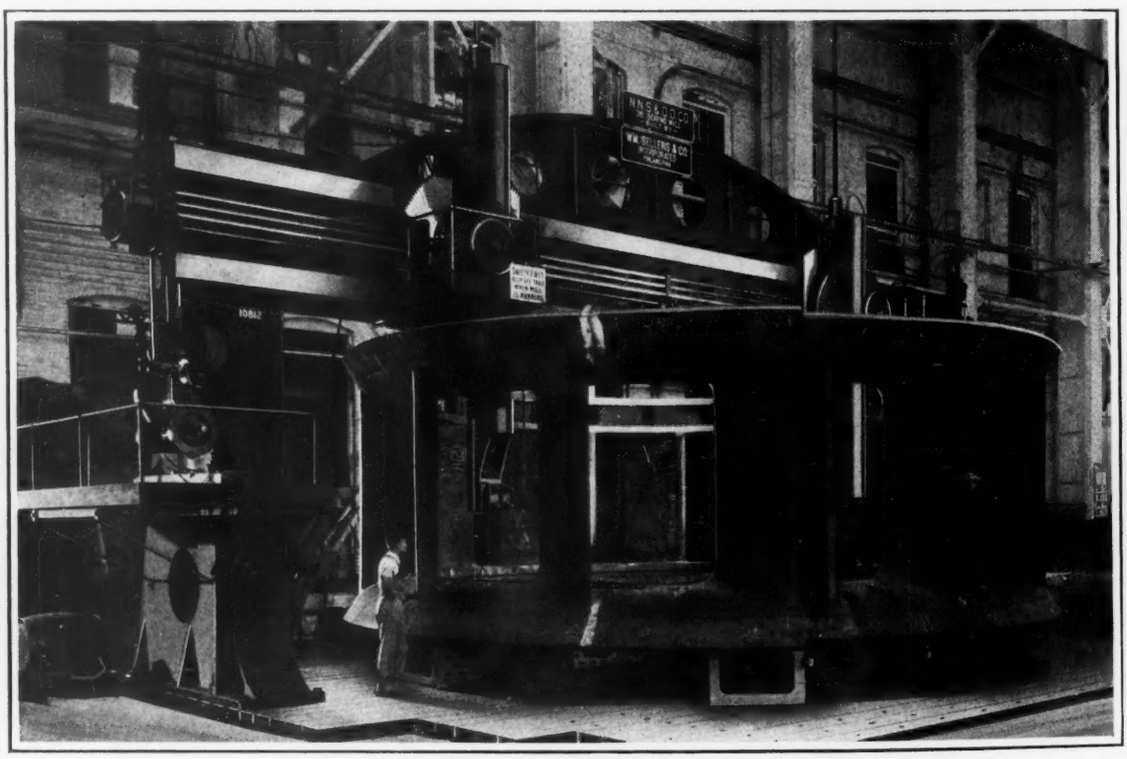


Fig. 3. Work of a Height Requiring Uprights of Two Sections in Place of the One-section Uprights Shown in Fig. 1

The feed and traverse mechanisms are mounted on top of the cross-rail. The feed mechanism is of a special design, having sufficient range to provide the proper amount of feed per revolution for a table speed range of 30 to 1. On the standard boring mill, the feed operates as a function of the table speed, and the feed mechanism is driven by a pinion meshing with the table gear. However, as the cross-rail has no connection with the table on this machine, the feed cannot be a function of the table speed, and its mechanism must therefore be independent and self-contained.

DRAW-CUT SHAPER AND CROSS-HEAD PLANING ATTACHMENT

A high-duty draw-cut shaper with an overhead ram-cap bearing and a screw-type outer table support is a recent development of the Morton Mfg. Co., Muskegon Heights, Mich. This machine, which is shown in Fig. 1, has been designed with a view to obtaining maximum rigidity and eliminating all spring or deflection of the ram, regardless of the length of stroke, as well as insuring alignment of the table and work at all times.

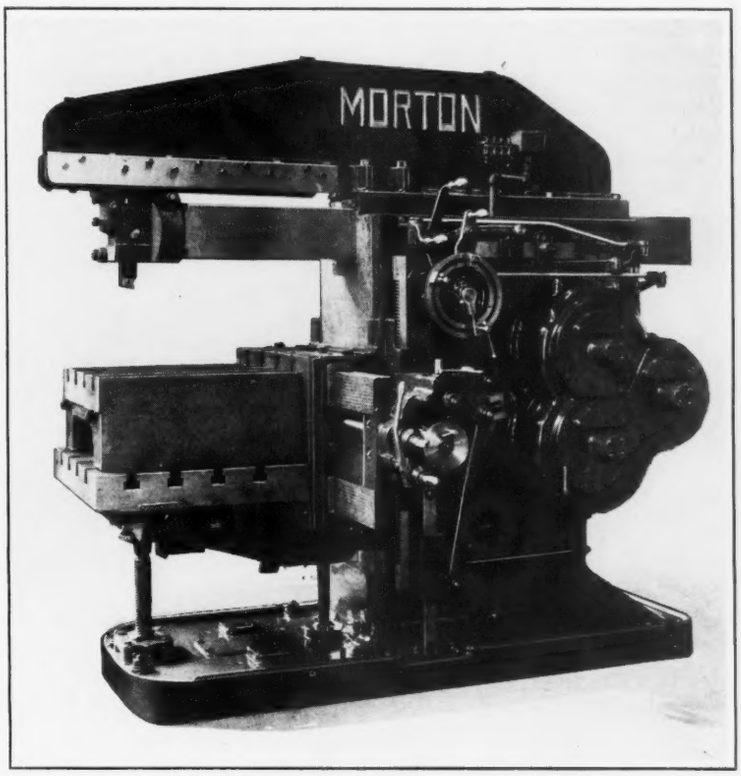


Fig. 1. Morton Draw-cut Shaper with Overhead Ram-cap Bearing and Outer Screw-type Table Support

A special tool-head is used which has an adjustable taper bearing that forms a support for the cutting tool both at the top and sides, and eliminates all possible deflection of the ram. A rapid power traverse in both horizontal and vertical directions is furnished as standard. Both the overhead ram-cap bearing and the screw-type outer table support can be furnished on the 32-, 38-, 48-, and 60-inch stroke draw-cut shapers made by this concern.

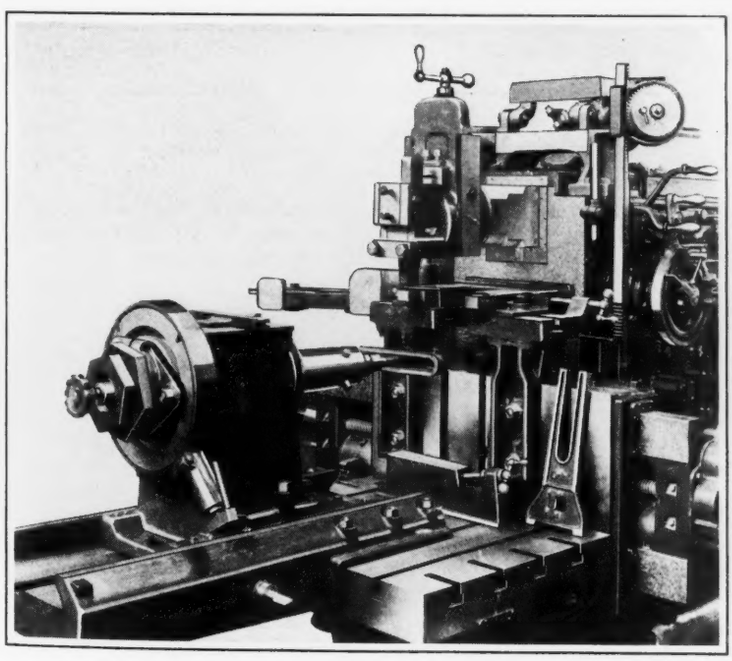


Fig. 2. Morton Planing Attachment for Locomotive Cross-heads

Fig. 2 shows an attachment developed by the same company for planing locomotive cross-heads. It is applicable to the 38-, 48-, and 60-inch draw-cut shapers built by this company. The base of this attachment is designed to be bolted to the lower table of the machine. It is relieved on the inside end to permit the maximum swing of the largest cross-heads.

The headstock is provided with a rack and gear for moving it along the base. It has journals for the arbor on which the cross-head is centered. This arbor holds the cross-head central from the tapered piston-rod hole, and is so designed that it is self-adjusting to compensate for any inaccuracy in the taper.

When a cross-head is mounted on the arbor, it can be rotated to the proper cutting position by means of the worm-gearing or by hand. It is set for planing parallel with the center line of the cross-head pin hole, by means of a taper leveling attachment. The headstock is planed and slotted to receive gages for setting the work accurately.

A special back bearing, which is bolted to the saddle, transfers the cutting strains to the machine column. This bearing is adjustable horizontally and vertically.

BLISS DOUBLE-CRANK PRESS WITH FOUR-SCREW SLIDE ADJUSTMENT

Thirty-six inches of slide adjustment are available on a double-crank press recently developed by the E. W. Bliss Co., Brooklyn, N. Y., instead of 5 or 6 inches which is the usual adjustment limit for the size. This press has been designed to meet the needs of automotive stamping plants, especially shops engaged in jobbing or limited production work. In such plants it is often necessary to change a high-cowl or fender die for a low die used in shaping a comparatively flat piece.

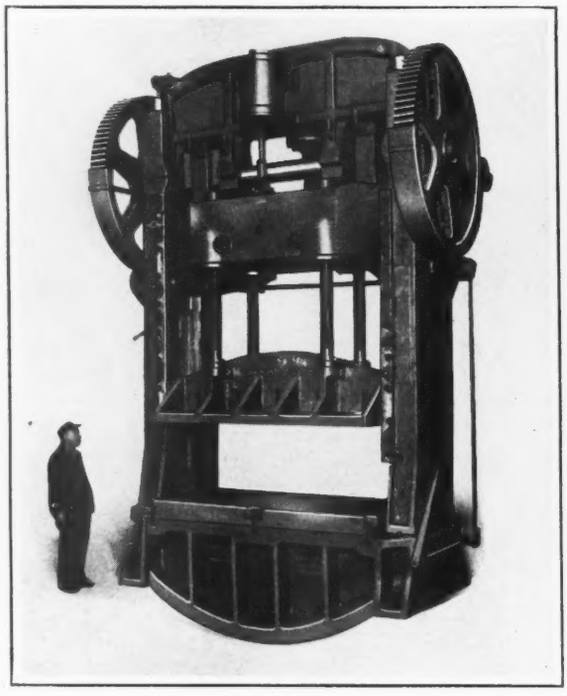


Fig. 1. Bliss Double-crank Press with Slide in Lowest Position

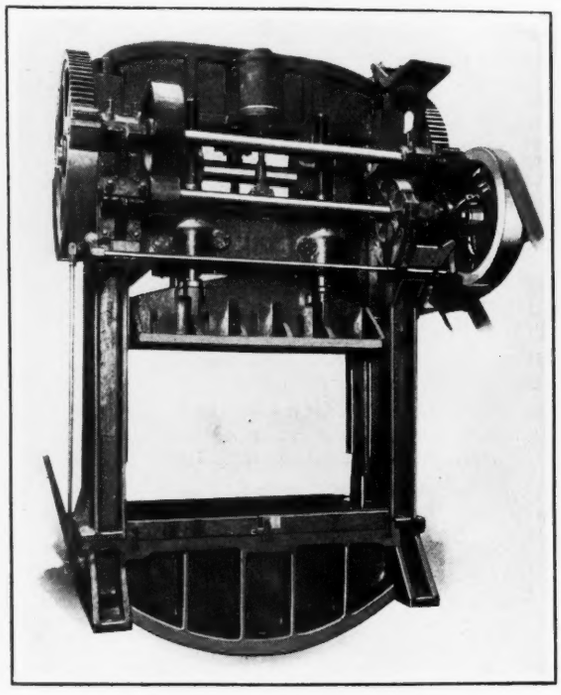


Fig. 2. Rear View of Press with the Four-screw Slide in Highest Position

A pair of non-adjustable pitmans or "solid connections" links the crankshaft to the cross-head. The latter carries four nuts which are suitably geared to an adjusting motor, and there is also a fine adjustment by hand. The nuts revolve in unison to advance the adjusting screws, which are flanged and bolted to the slide. The advantages claimed for this construction include strength of the solid connections, in comparison with adjustable ones; application of the pressure to four points on the slide instead of two, thereby reducing stresses and improving alignment; screws free from bending moment due to friction; an air cylinder or springs for counterweighting the slide; and improved means for mounting the adjusting mechanism on the cross-head.

Fig. 2 shows the driving mechanism. The flywheel, which runs on Timken tapered roller bearings, is combined with an improved multiple-disk clutch. A separate brake-drum serves to keep the heat generated by the brakes away from the clutch. Removal of the outboard bearing permits the clutch disks to be disassembled without dismounting the shaft, should the disks require new facings. Timken bearings are also provided for the driving shaft.

Some of the important specifications of the press illustrated are as follows: Width between uprights, 108 inches; maximum and minimum distances from the bed to the slide with the stroke down, 60 and 24 inches, respectively; number of strokes per minute, 15; and weight of machine, about 140,000 pounds.

AUTOMATIC HOB AND TOOL GRINDER

Automatic table travel with the backlash compensated for and automatic indexing of the work from flute to flute or tooth to tooth are the principal features of the Reinecker hob and tool grinder. This machine is being introduced on the American mar-

ket by the George Scherr Co., 144 Liberty St., New York City. The advantages claimed for the automatic features in grinding hobs and relieved milling cutters are uniform height and length of teeth. In the case of relieved hobs or formed cutters, all cutting edges are ground radially to the center.

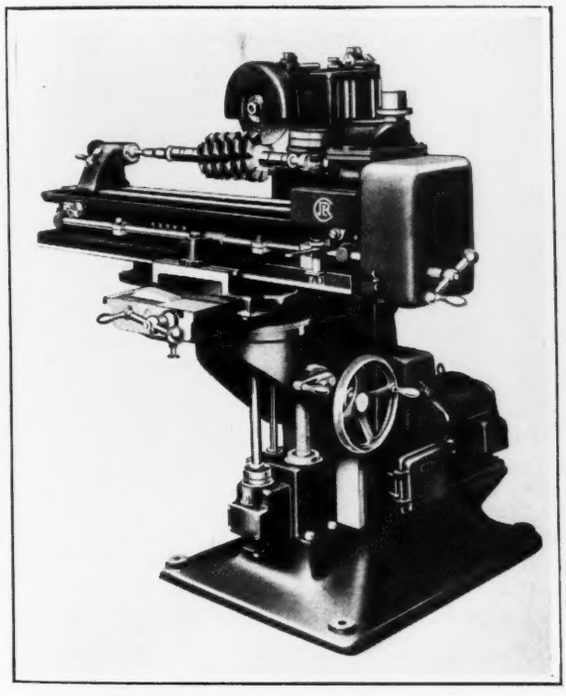
The standard machine is arranged with a motor drive as illustrated, but it can be supplied with a single pulley for driving from a countershaft. The motor is mounted on an extension of the base, and is direct-connected to the main driving shaft inside the column.

Two speeds are provided for both the grinding-wheel spindle and the automatic table travel, both speeds being changed by means of convenient levers. Adjustments of the indexing mechanism for number of teeth and for spiral lead are obtained through change-gears. The automatic dividing head casting is made of an aluminum alloy, a patented feature which reduces the weight of the overhang and correspondingly increases the load capacity of the machine.

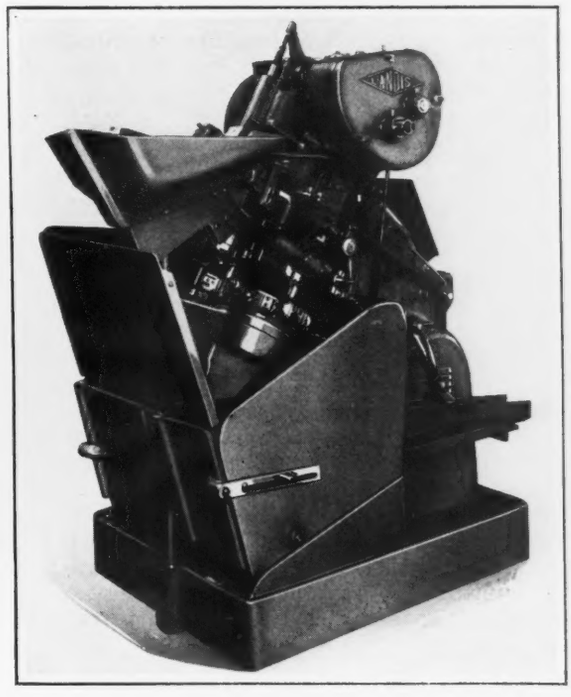
For taper-grinding, the table top can be swiveled and set according to an accurate scale that is provided. The cross-slide can also be swiveled up to 45 degrees, and a circular scale is furnished for making such settings. Vertical and horizontal adjustments are made through a crank, screw, and dial.

The wheel-head can be turned completely around, a feature which is of importance in grinding multiple-thread hobs having a steep lead. The shape of the wheel is maintained with a diamond dressing device incorporated in the wheel-head.

When specially ordered, the machine can be equipped with either a cylindrical or an internal grinding attachment or both. The machine is built in two sizes which accommodate work up to a maximum diameter of 8 and 16 inches, respectively. The maximum grinding length with the automatic dividing head is 25 1/2 inches on one machine and 29 1/2 inches on the other. The smaller machine weighs 2100 pounds, and the larger, 3550 pounds.



Automatic Hob and Tool Grinder Introduced on the Market by the George Scherr Co.



Landis Automatic Forming and Threading Machine for Bolts and Screws from 1/2 to 1 Inch

LANDIS AUTOMATIC FORMING AND THREADING MACHINE

Bolts and screws from 1/2 to 1 inch in diameter and up to 6 inches in length, with a length of thread up to 2 1/2 inches, can be produced by an automatic forming and threading machine recently developed by the Landis Machine Co., Waynesboro, Pa. Any style of point can be cut—cupped, flat, round, dog-point, or full-cone. In appearance, this machine is similar to the 3/4-inch equipment described in October, 1929, MACHINERY, on page 110, and in January, 1928, MACHINERY, on page 391. New features have been incorporated, however, to make it faster, safer, and more accurate. The machine employs a 1 1/16-inch "Lanra" head of the pull-off type, equipped with Landis chasers.

The bolt or screw blanks are loaded into a hopper from which they are delivered through a magazine to fingers that transfer them to grips in the turret chuck. The length of the finished bolts is controlled by an adjustment of the graduated transfer bracket.

The time element for the return of the forming and threading head and the indexing of the turret chuck is constant, regardless of the diameter, pitch, and length of thread, the quality of the material, or the threading speed. The instant that the forming and threading operations are completed, an automatic accelerated motion that is independent of the cutting speeds withdraws the forming and threading spindles and indexes the turret.

By the use of a new chucking arrangement, the chucking and indexing time is decreased considerably and production increased. The new chuck has three stations, the same as the turret chuck of the 3/4-inch machine. One of these is used for unloading and loading work, one for cutting to length and forming the end of the screws, and the third for threading. These operations are performed simultaneously. The threading head is equipped with a safety device which closes the head in case a screw is accidentally twisted off.

An oscillating conveyor that can be arranged for delivering the finished work to either the front or the rear of the machine is included as standard equipment. Other methods of delivering the work can be provided to suit individual needs. This machine will be in operation at the convention of the American Railway Association to be held in Atlantic City from June 18 to 25.

BLOUNT WET GRINDER FOR TUNGSTEN-CARBIDE TOOLS

A motor-driven wet cup-wheel grinder especially designed for sharpening tungsten-carbide tools is being placed on the market by the J. G. Blount Co., Everett, Mass. This machine is equipped with a heavy spindle running in self-oiling phosphor-bronze bearings, the construction giving the vibrationless operation desirable for producing keen edges on tungsten-carbide tools. The spindle is fitted with a 14- by 4-inch cup-wheel having a 1 1/2-inch wall. It is thus possible to grind straight side angles on tools.

To facilitate grinding rake and clearances of tools to correct angles, an adjustable table is provided. This table can be tilted at angles in two different planes with respect to the wheel, and a third angle is obtainable by means of a sliding protractor guide against which the tool is held in the grinding process. The table may be adjusted vertically to permit various sizes of tools to be ground, and it has a horizontal adjustment to compensate for wheel wear.

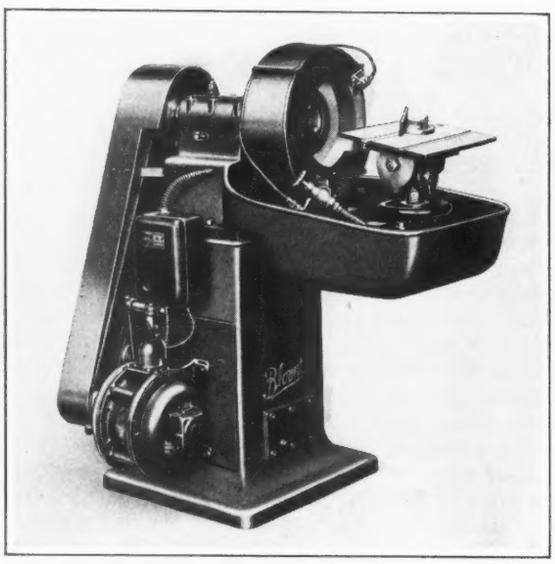
The grinding process is performed free hand. After the table has been set to the required angles, the tool is held against the sliding protractor and guided across the wheel face. Grinding shocks are absorbed by holding the tool in this way.

A large volume of water under high velocity is directed to the wheel face at all times, while a secondary nozzle at the top of the guard provides an additional stream to the point of grinding. The wheel guard is designed to eliminate splashing or hindrance of vision.

The machine is driven by a two-horsepower motor which is belted to the spindle. If desired, a "Texrope" or similar drive can be furnished. The weight of the machine is approximately 1100 pounds.

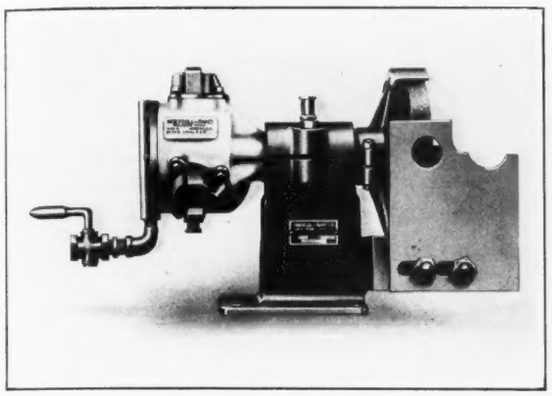
HISEY BUFFING AND POLISHING MACHINE

A Model M buffing and polishing machine equipped with a "TexDrive" is the latest addition to the equipment manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The machine is of a goose-neck design with the spindle and buffing wheels extending out from the base to permit easy handling of large or

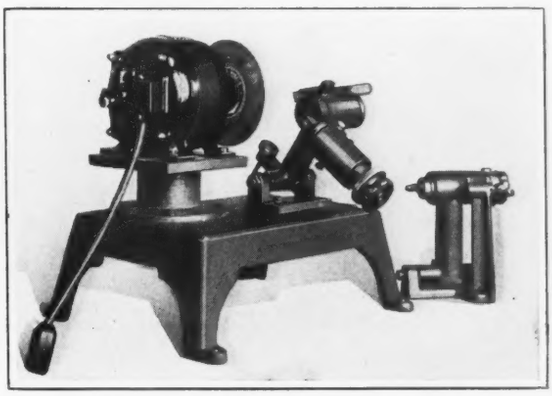


Blount Cup-wheel Grinder for Sharpening Tungsten-carbide Tools

Hisey Buffing and Polishing Machine with Goose-neck Base



Ingersoll Air Grinder Designed to be Installed on a Bench or on a Portable Air Compressor



Wells Sharpening Machine for Die-sinking Cutters of the Tapered and Ball Types

odd-shaped pieces. This feature enables the operator to stand close to the machine or to sit comfortably when the nature of the work permits him to do so.

The motor is mounted externally on a rigid four-point support which avoids the possibility of inexperienced operators adjusting the belts too tightly. The motor is ball-bearing equipped and has a dovetailed sliding base. Adjustments are made by turning a handwheel.

Different spindle speeds can be secured by changing the motor pulley. The design of the machine is such that the belt can be changed without pulling the spindle through the bearing housings, as the entire spindle assembly can be conveniently removed. Two ball bearings are provided for each end of the spindle; Timken roller bearings can be furnished if desired. The covers on the bearing housings are provided with labyrinth seals, which prevent dust and dirt from getting into the bearings.

INGERSOLL-RAND BENCH-TYPE AIR GRINDER

A pneumatic grinder which can be bolted to a bench or to a portable air compressor has been brought out by the Ingersoll-Rand Co., 11 Broadway, New York City. In this equipment, which is shown in the illustration, the flow of air to the motor is controlled by a hand-operated globe valve. The machine has a free speed of 3000 revolutions per minute, and is designed to receive a vitrified grinding wheel of from 6 to 8 inches in diameter, with a 1/2-inch face. At the end of the grinder spindle, a chuck is provided to receive drills or reamers with a 1/2-inch straight shank.

The motor has three cylinders, spaced about the center line of the spindle, all of which deliver power to one crankpin. The motor operates in a bath of lubricant, all moving parts being continuously immersed. The exhaust is directed through the base of the machine, a feature which prevents grindings from being blown into the face of the operator. A steadyrest in front of the wheel aids the operator in holding the work.

WELLS CUTTER AND SCRAPER SHARPENING MACHINES

A machine for sharpening die-sinking cutters has been placed on the market by the Wells Mfg. Co., P. O. Box 613, Greenfield, Mass. As will be seen from the illustration, the grinding wheel of this equipment is mounted directly on the motor shaft. The motor is of 1/6 horsepower rating and operates on 110- or 220-volt current. The machine will grind regular die-sinking cutters of the tapered and ball or cherry types.

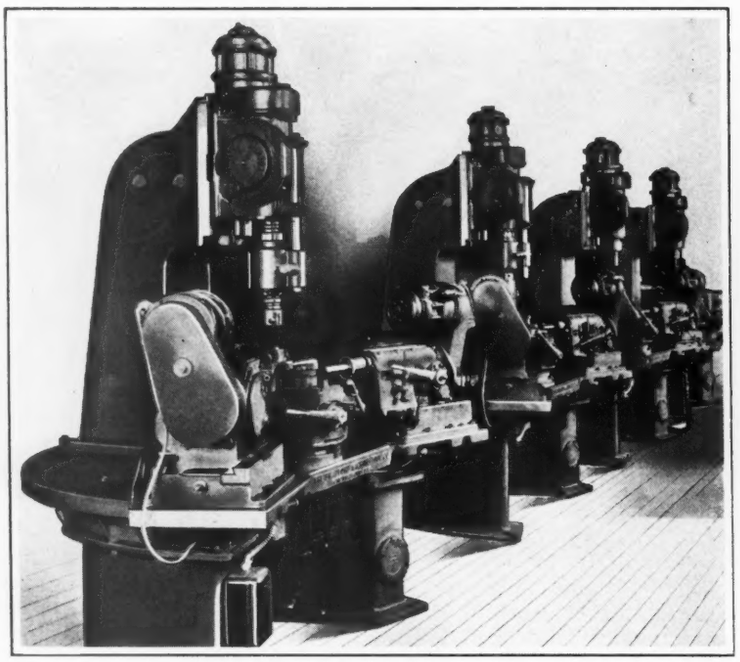
Two work-heads are furnished. One head is intended for grinding straight or tapered cutters by holding the cutter in a draw-chuck and revolving the spindle by means of the knob. A cam on the spindle causes the work to advance toward the wheel and produces a radial relief.

The other work-head is for grinding the ball cutters or cherries. These cutters are also held in a draw-chuck and a device is provided to locate the cutter for grinding to the correct radius. The device is suitable for cutters of different sizes and radii. A diamond truing device is furnished.

A machine of the same general construction as the one described in May MACHINERY, page 739, has also been brought out by the concern for sharpening chisels, scrapers, and carpenters' plane irons. The difference between this machine and the one previously described lies in the construction of the work-holding fixture. The work is held by hand on a flat supporting plate which is rocked past the wheel by swinging it on pivots. The supporting plate will hold any chisel or scraper up to 3 5/8 inches wide and can be adjusted for any angle of the cutting edge.

BRADFORD DRILLING, COUNTERBORING, TAPPING, AND REAMING MACHINES

The battery of machines shown in the illustration was developed by the Bradford Machine Tool Co., Cincinnati, Ohio, for performing two progressive operations on the front- and rear-brake



Battery of Bradford Unit-built Machines Used for Operations on Automobile Brake-housing Hangers

housing hangers of an automobile. Each machine is arranged for performing both operations on the two parts. All the machine elements, such as tables, pedestals, columns, and drilling or tapping units, are standard units assembled to meet the requirements of this particular installation.

The first operation on the two parts consists of drilling two 13/32-inch holes 1 1/8 inches deep by means of the horizontal units, and of counter-boring another hole with a combination tool. The second operation consists of reaming the first two holes and of tapping the third. The reamers are operated at a speed of about 110 feet per minute, while the tapping speed is 45 feet per minute. The floor-to-floor time is twenty-four seconds.

Each unit is equipped with an individual motor. A central control enables each machine to be started and stopped by means of a push-button. Cutting lubricant is supplied to the tools by means of a turbine pump.

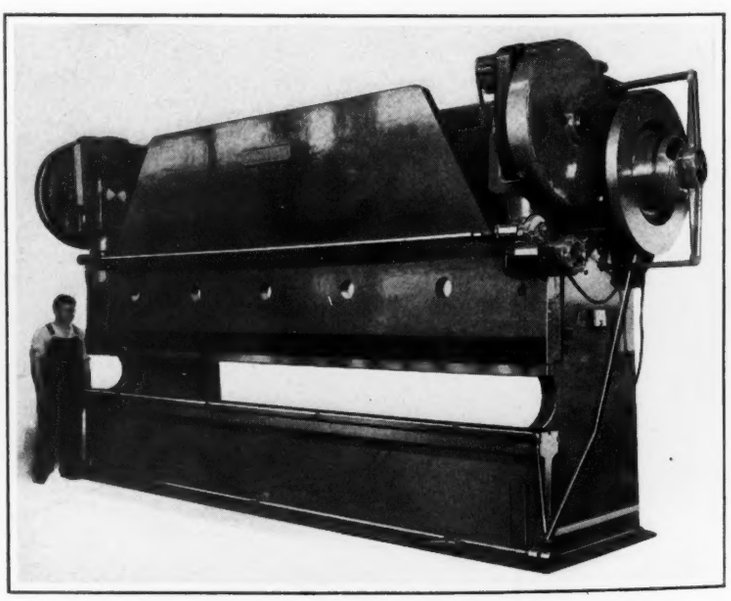
The operations illustrated require that the cutting tools overlap each other in the same hole, and so the cams that control the feed of the individual units are arranged to give an interlocking action on the tools. This necessitates a positive and accurate control of the feeding mechanism, which is obtained by means of a hand-valve located at the right front of the machine. This valve connects with an air cylinder attached to the tripping levers of the individual heads.

CINCINNATI PRESS BRAKE

A press brake of unusual length, which was recently built by the Cincinnati Shaper Co., Cincinnati, Ohio, is shown in the accompanying illustration. This press has an over-all die surface of 16 feet, and there is a distance of 14 feet 6 inches between the housings. All main members are made of rolled steel plates. The machine has a capacity for forming right angles from 3/16 inch steel up to a length of 16 feet and to a 3/16-inch inside radius, over a 1 1/2-inch die.

One of the important features of the machine is the provision of cylindrical or spherical bearings throughout between load-carrying members, particularly for the saddle and the ram and for the mounting of the bed on the housings. This construction does away with all sharp corners and allows full action of every member. Another important feature is that all loads are transmitted directly up the center line of both housings, with a view to preventing distortion from eccentric loads.

A motor drive is provided for the ram adjustment. Power is transmitted to the flywheel through multiple V-belts. The ram guides are gibbed in both directions. Lubrication is fully automatic.



Cincinnati Press Brake which has an Over-all Die Length of Sixteen Feet

FAFNIR FELT SEAL BALL BEARINGS

A line of ball bearings with felt seals has been developed by the Fafnir Bearing Co., New Britain, Conn., with a view to relieving machine builders from the necessity of designing means of keeping lubricant in bearings and foreign matter out. The seal consists of a pressed-steel shell which is permanently fitted over one face of the bearing and shaped to contain a felt ring or washer. The inner ring of the bearing is wider than that ordinarily used, and thus allows the felt ring to bear closely on it, effectively sealing the bearing against the entrance of dirt or the escape of lubricant. A thin steel washer placed between the bearing and the felt holds the latter firmly in place against the outer shell and also aids in sealing.

The felt seal is fitted closely around the inner ring, but not so tightly as to cause frictional resistance. The steel outer shell is fitted into a groove in the outer ring, so that there is no interference with the ground outside surface. Ten sizes of these felt seal bearings are now available for application to small high-speed equipment, such as portable tools and electric motors.

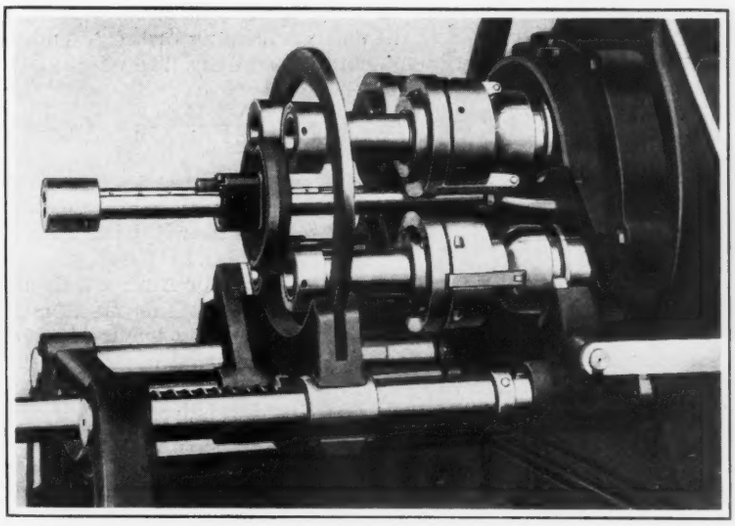


Fig. 2. Support for Stock Feed Mechanism of the Gridley Automatic

GRIDLEY HEAVY-DUTY FOUR-SPINDLE AUTOMATIC

Four independently operated cross-slides are furnished as standard equipment on the Model G-A four-spindle Gridley automatic, which has recently been developed by the National Acme Co., Cleveland, Ohio. Each cross-slide is supported on the outer edges and rides on hardened strips. The two lower slides are operated by a separate drum directly underneath and in the center of each slide. On the outer ends of these drums there is an extra set of cams which actuates the top slides. It is claimed that this construction eliminates all vibration.

The two bottom slides are intended for rough-forming operations, while finish-forming and cutting-off are done in the two top positions. End working tools are carried in a heavier main tool-slide which works back and forth on the stem of the spindle carrier. The spindle carrier and the main tool-slide are of the Gridley integral construction.

Spindle speeds from 35 to 500 revolutions per minute are available, and with a 1/2-inch cam the feed-box range is from 0.001 to 0.140 inch per revolution. An improved vertical disappearing stop is provided. The plunger rises and falls, being operated by a cam on the inside of the turret-slide cam. This arrangement permits standard tooling to be used on the fourth spindle, the same as in any of the other three positions.

The column of the machine in front of the gear-box section is bored in line with the spindles in the second and third positions. This permits the use of high-speed drilling attachments or accelerated boring or reaming attachments in these positions. The machine is equipped with a large pan that is open on all four

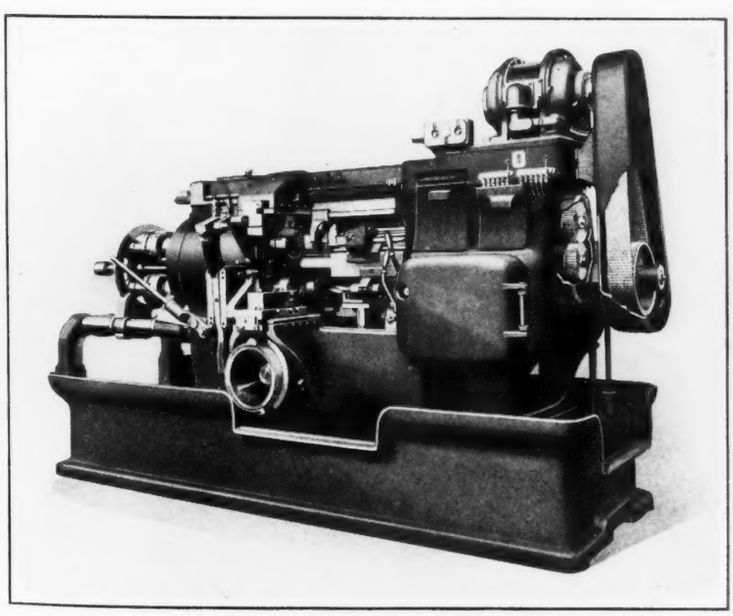


Fig. 1. Gridley Automatic with Four Independent Cross-slides Furnished as Standard Equipment

sides so that chips and work can be removed without stopping the machine. This automatic is now built in four sizes, with capacities of 1 3/8, 1 5/8, 2 5/8, and 3 5/16 inches, respectively.

ZEH & HAHNEMANN PILLAR TOGGLE PRESSES

A new line of pillar toggle presses, of which the No. 12 size is here illustrated, has recently been brought out by the Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J. The No. 12 size is rated to yield a pressure of 150 tons normally; however, it is tested at an overload of 50 per cent, or at 225 tons. This press weighs 12,000 pounds. It is provided with a solid frame that is reinforced by hot-shrunk steel stanchions. The speed of operation is forty strokes per minute.

Through the arrangement of the toggle drive, a practically uniform speed of the slide is obtained toward the end of the down stroke. This feature makes the presses particularly well adapted to extruding collapsible tubes, and it is also of advantage in performing ordinary embossing operations. The press motion is controlled by a non-repeating clutch. Automatic feeds can be provided.

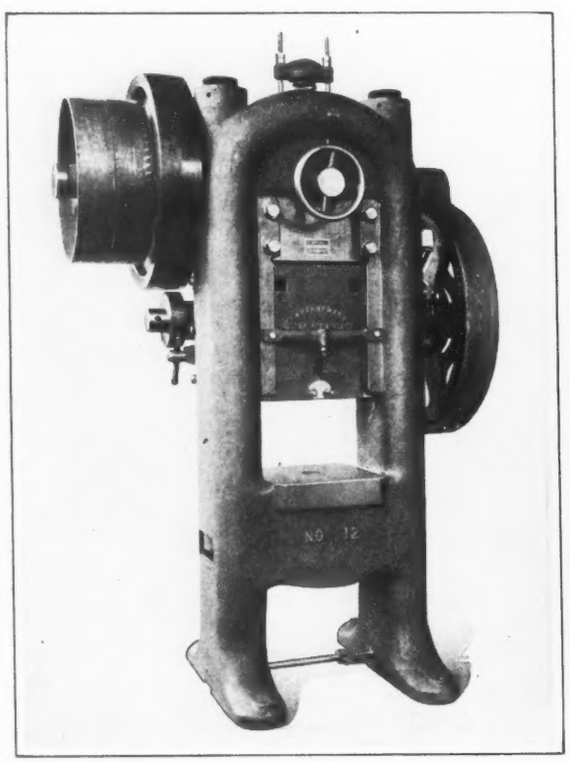
BETTS OILGEAR-FEED CAR-WHEEL BORER

A Betts heavy-duty car-wheel borer equipped with an Oilgear feed has recently been built by the Consolidated Machine Tool Corporation of America, Rochester, N. Y. In this machine the feeds and rapid traverse are entirely controlled by oil pressure, which enables heavy feeds to be used and rapid production to be attained. The entire cycle of operations is automatic, the operator merely starting the machine and then being free to do other work while the car wheel is being machined.

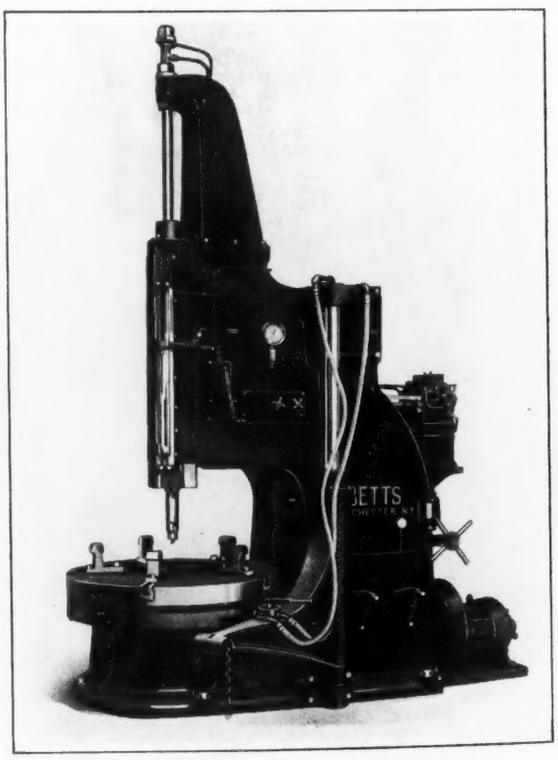
A hoist is furnished with each machine for placing the car wheels on the table. This hoist may be operated either mechanically or pneumatically and may be of a single or double type. The wheel is automatically chucked when the machine is started.

The boring-bar, to which roughing, finishing, and chamfering cutters are attached, is lowered by the rapid traverse as soon as the feed-lever is thrown in. As the roughing cutter reaches the bore, the bar feed is automatically cut down to the proper rate for rough-boring. When the roughing cut is completed, the rate of feed changes so that the finishing cutter enters the work at the desired finishing feed. Upon the completion of the finishing cut, the edge of the car wheel is automatically chamfered by the cutter provided for that purpose, after which the boring-bar is returned automatically by the rapid traverse to the starting position.

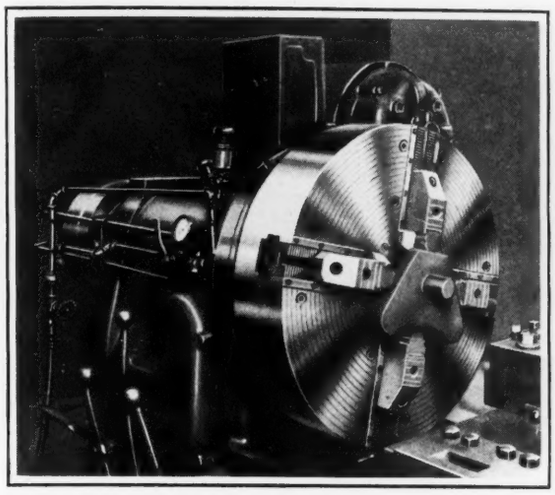
Four table speeds are obtainable. Feed rates can be instantly changed during the cut if desired, by means of convenient knobs. The machine can also be stopped at any point in the work. When desired, a hub facing head can be applied.



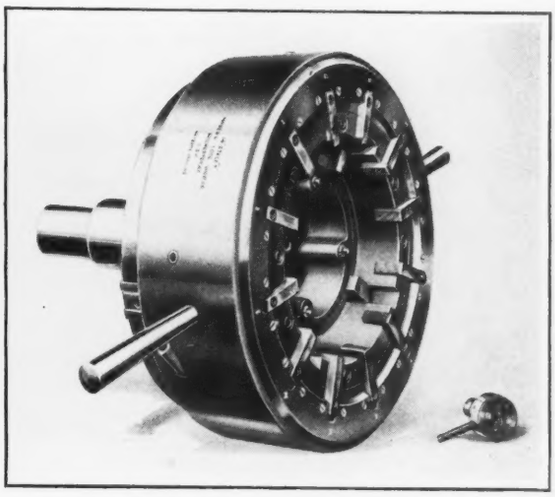
Zeh & Hahnemann Pillar Toggle Press Rated at 150 Tons Capacity



Betts Car-wheel Boring Machine with Oilgear Hydraulic Feed and Traverse



Hannifin Four-jaw Air Chuck for Holding Irregular-shaped Work



Fourteen-inch Self-opening Die-head Made by the Modern Tool Works

HANNIFIN FOUR-JAW "DUPLEX" AIR CHUCKS

Work of irregular shape can be chucked instantly in a line of four-jaw "Duplex" air chucks recently developed by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. These chucks center work accurately across two diameters, regardless of variations from the nominal dimensions, apply uniform pressure on all four sides of the work, and can be loaded and unloaded as quickly as a conventional three-jaw air chuck.

The illustration shows a 28-inch chuck holding a punch-holder of irregular shape. These punch-holder castings are made in a wide range of shapes and sizes. To take care of various sizes, the chuck is equipped with adjustable master jaws, the spacing between which can be changed quickly to suit the size and the shape of casting to be machined. Square, rectangular, oval, and other irregular shapes can be held.

These chucks are, in fact, a combination of two double-jaw chucks which operate independently of each other. One pair of jaws can be moved toward the center until contact is made with the work, the other pair moving a greater or lesser distance until contact is also made with the work. It does not make any difference which pair makes contact first.

For operating these chucks, a "Duplex" air cylinder is employed. Two pistons are provided in this cylinder, the smaller one telescoping inside the larger. The bore in the larger piston serves as the cylinder wall for the smaller one. The larger piston is connected to one pair of jaws by means of a draw-tube, and the smaller piston is connected to the other pair of jaws by a draw-rod which is contained in the draw-tube of the larger piston. The chucks are available in 15-, 18-, 21-, 24-, and 28-inch sizes, and the cylinder in 12-, 14-, and 16-inch sizes.

FOURTEEN-INCH SELF-OPENING DIE-HEAD

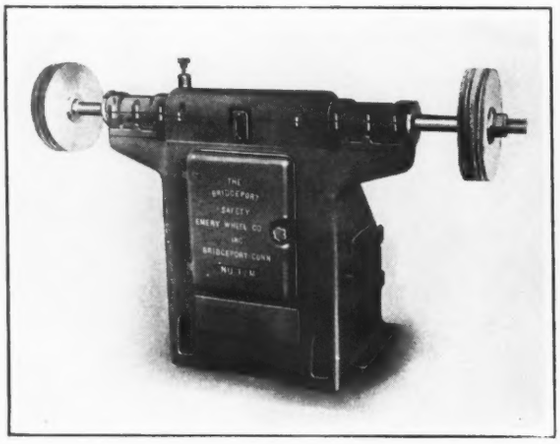
What is believed to be the largest stationary-type self-opening die-head ever made for use on turret lathes has just been finished by the Modern Tool Works Division of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. This die-head has a capacity for cutting threads from 10 to 14 1/4 inches in diameter. It has an outside diameter of 21 1/2 inches, while the length less the shank is 8 1/2 inches. In the illustration, this large die-head is shown in comparison with a standard 1/2-inch die-head.

One of the features of the large die-head is its positive and easy operation, it being mentioned that it can be operated as readily as a die-head one-eighth its size, owing to the fact that the cam ring is mounted on two sets of roller bearings. With this construction, friction is reduced to a minimum when the die is opened and closed.

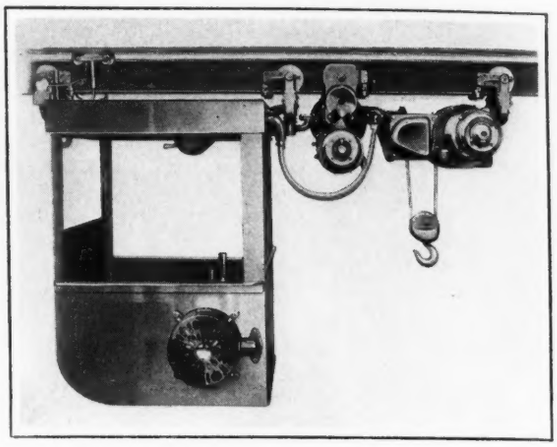
Each chaser, of which there are twelve to a set, is held in its slide by means of one screw and can be quickly removed. The chaser slides, in turn, are connected to the large cam ring, so that at the point of opening, each chaser is pulled positively out of the cut. Adjustments for size are easily made, and a simple device prevents changing of the size when the die has once been set. An internal trip is adjustable to suit the length of thread.

BRIDGEPORT MOTOR-DRIVEN BUFFING LATHES

Buffing and polishing lathes adapted for handling large or awkward work that requires plenty of room for swinging are being introduced on the market by the Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn. These lathes are also intended for application where a satisfactory spindle speed cannot be obtained with direct-connected alternating-current motors, as a speed which will meet most requirements may be selected by changing the driving sheave on the motor.



Bridgeport Buffing and Polishing Lathe Designed to Handle Large and Awkward Work



Louden Motor-driven Trolley which has a Hook Capacity of 4000 Pounds

These machines are built in four types, with motors of from 3 to 10 horsepower. The spindle speeds range from 2000 to 3000 revolutions per minute. As may be seen from the illustration, the base is straight at the front so as to allow all possible working space in front of the wheel-spindle, together with freedom of foot movement for the operator. The General Electric alternating-current squirrel-cage motors used take an overload of 25 per cent with a temperature rise of not over 55 degrees C.

The wheel-spindle is driven from the motor through V-belts. The motor is located inside the base on a saddle which may be swung up or down to make center adjustments of the drive. The wheel-spindle is carried in four sets of ball bearings and the motor is also ball-bearing equipped. The standard distance between the wheels is either 52 or 63 inches, but this distance can be varied to suit requirements.

LOUDEN MOTOR-DRIVEN TROLLEY

A motor-driven trolley with a hook capacity of 4000 pounds has recently been brought out by the Louden Machinery Co., Fairfield, Iowa, to suit various handling requirements in shops—from raw materials to finished products. Rope, push-button, remote, or dispatch control are available. The cab may be of an open design as illustrated, or closed. It can be furnished with a platform when the operator must dismount frequently. The mechanical details of the trolley are designed to operate dependably even when dirt, dust, and other foreign materials are present. All rotating parts, including the motor, are provided with ball bearings.

LANGELIER DRILLING MACHINE WITH 462 SPINDLES

Four hundred and sixty-two holes are drilled simultaneously in Celotex boards by the machine illustrated in Figs. 1 and 2, which was recently built by the Langelier Mfg. Co., Providence, R. I. This machine is semi-automatic, the operator simply placing the boards in position for drilling and taking them out when the work has been completed. The drills have a speed of 1200 revolutions per minute, and are fed at the rate of 21 inches per minute. The main element of the machine consists of a 462-spindle drilling head, which is mounted in a fixed position on the left-hand end of the bed. A feeding head, hydraulically operated through Oilgear equipment, is mounted on a sub-saddle at the right-hand end of the bed.

The construction of the drilling head is of special interest, both because of the large number of spindles driven at the same time and because of their close spacing. There are twenty-one horizontal rows of spindles, 17/32 inch apart, each row con-

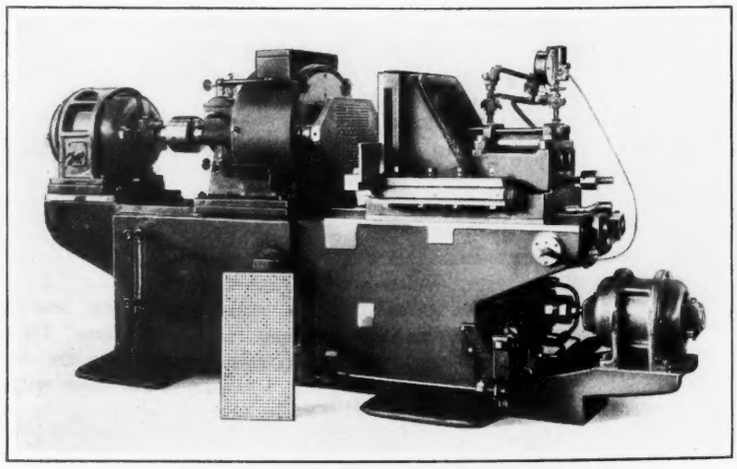


Fig. 1. Langelier Drilling Machine with 462 Closely Spaced Spindles

taining twenty-two spindles also spaced at center distances of 17/32 inch.

The spindles are crank-driven by a plate which has an integral trunnion mounted in a 7-inch radial ball bearing which is housed in a hole bored eccentrically in the end of the main driven spindle. The centrifugal force created by the crank drive is counteracted by an opposing weight on the end of the main spindle.

The spindle driving plate is operated by and runs on eight large steady crank spindles, the crank ends of these spindles being driven by ball bearings housed in the driving plate. The crank ends of the drilling spindles run in bushings in the driving plate. Ball bearings are provided for the various members, and the construction is such as to relieve the drilling spindles of all strain except that caused by drilling. The drilling head is driven by a 20-horsepower direct-connected motor.

It will be evident that the great number of parts in this head which are running at 1200 revolutions per minute within a confined space create considerable heat. To carry off this heat, a 25-gallon capacity pump delivers oil through the drilling head. In the tank, the oil is kept cool by a cold-water pipe coil.

The feeding head has a total travel of 5 inches, and is operated by a hydraulic cylinder bolted in a fixed position on top of the sub-saddle, the latter having a traverse of 24 inches. This allows room for exchanging drills or for removing the drilling head from its housing, if this should prove necessary. The Oilgear mechanism operates the feeding head back and forth continuously unless stopped by a foot-treadle. This machine has a weight of approximately 7500 pounds.

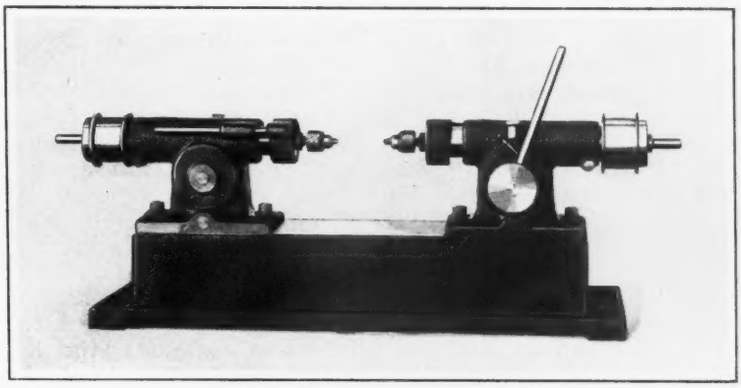


Fig. 3. Langelier Bench-type Duplex Drilling Machine

The Langelier Mfg. Co. is also introducing on the market at this time a horizontal high-speed bench-type duplex drilling machine of the construction shown in Fig. 3. This machine is designed for simultaneously drilling or countersinking the ends of rods or similar work. The drilling heads are bolted to the bed in fixed positions to suit the length of the work. The spindles can be run at a maximum speed of 6000 revolutions per minute and have a capacity for drills up to 3/8 inch. The weight of the machine as illustrated is approximately 200 pounds.

This machine is also made in several modified forms; for instance a table and legs may be provided and an underneath motor drive for each head. Also, an automatic feed release may be supplied for the right-hand head when holes have to be drilled through the entire length of the work.

GROOVING CUTTERS FOR "VICTAULIC" JOINTS

Pipe and casing are grooved to suit "Victaulic" couplings by means of a cutter which has been developed by the Landis Machine Co., Waynesboro, Pa., for application to the pipe threading and cutting machines made by this concern. As illustrated, a num-

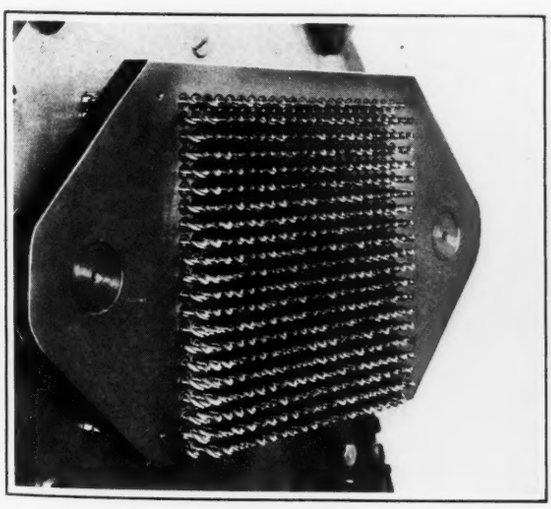
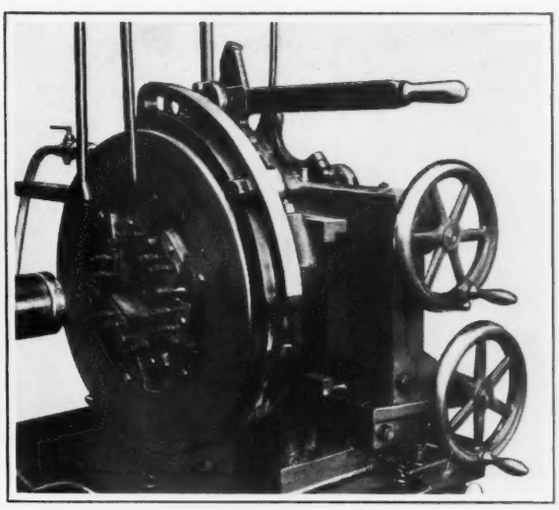


Fig. 2. Four-hundred and Sixty-two Drills with 17/32-inch Center Distances



Set-up of Landis Grooving Cutters for Producing "Victaulic" Coupling Grooves

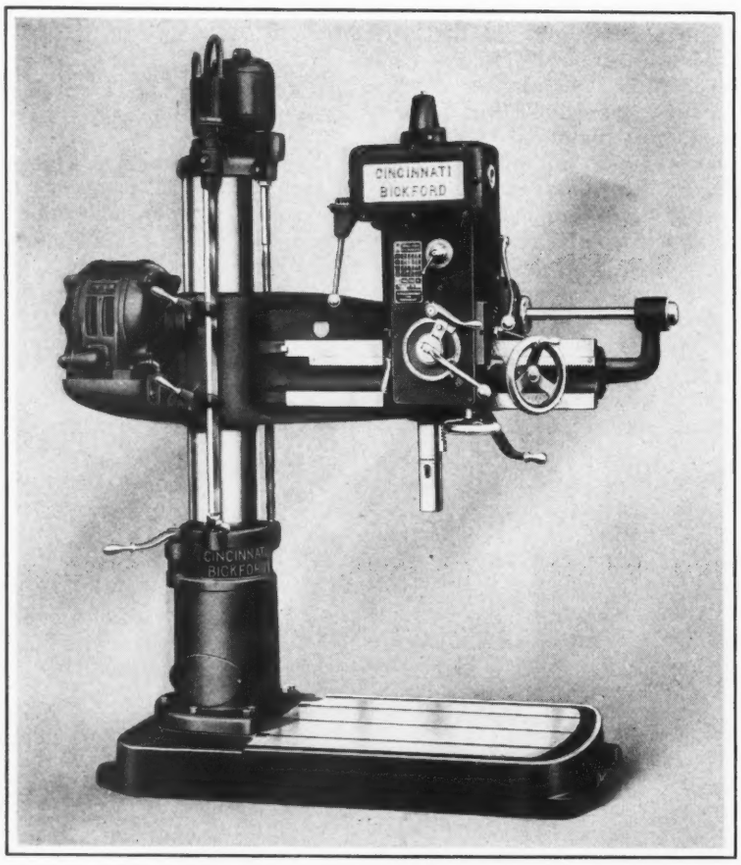
ber of cutters are placed in the regular chaser holders of the stationary die-head used for threading standard pipe and casing. The grooving cutter is made on the same principle as the Landis chaser, but it differs from the chaser in that the thread form is omitted entirely and the cutter face is flat except where the grooving offset is located.

The grooving section of the cutter corresponds in height and width to "Victaulic" standard grooves. The depth of the groove is controlled by the height of the offset, but variations in the depth of cut can be obtained by adjusting the die-head. The distance from the end of the pipe to the groove is set by means of two stop-blocks which are attached to cutters diametrically opposite each other.

To generate a groove, the head is first adjusted to the pipe size, and then the head in the open position is advanced to the work by means of the carriage. When the pipe comes in contact with the stop-blocks, the cutters are located properly for forming the groove. By closing the head, the operator then feeds the cutters into the pipe until the head reaches its closed position, when the groove is completed. The number of cutters used in a head ranges from six to eight. "Victaulic" cutters and stop-blocks can be obtained for pipe and casing ranging from 2 1/2 to 20 inches in diameter.

CINCINNATI-BICKFORD RADIAL DRILLING MACHINE

A three-foot radial drilling machine known as the 2-A, has been added to the line of equipment built by the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio. This new machine is a lighter type than those of the "Super Service" line manufactured by the concern, but it possesses the same advantages of a constant speed drive and of having all speed changes made at the head. It is built with a 3-foot arm on a 9-inch column, and has a speed range of from 71 to 1500 revolutions per minute.



Cincinnati-Bickford Radial Drilling Machine of Lighter Type than the "Super Service" Line

The important features of the machine include a twelve-speed head which incorporates ball and roller bearings in its construction, is fully enclosed, and is automatically oiled. There is a centralized control of all speeds and feeds at the operating position. The source of power is a direct-connected constant-speed motor. A compact drive arrangement is obtained by coupling the motor direct to the arm-shaft.

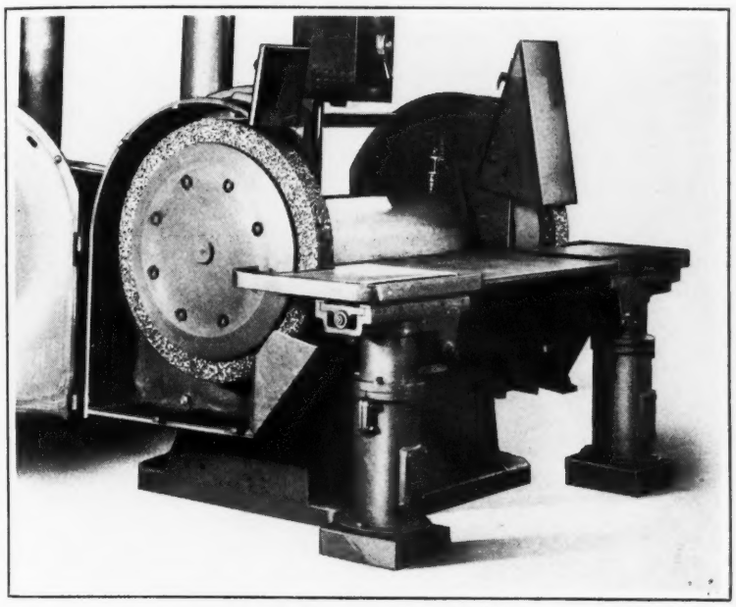
The driving clutches operate at a constant speed, due to the fact that all spindle speed changes are made in the head and the arm-shaft speed is constant. The speed range is intended to suit the drilling of diameters from 3/16 to 4 inches. The machine is available with either the constant-speed motor drive arrangement illustrated or a constant-speed pulley belt drive.

"BLUE DIAMOND" HIGH-SPEED DRILLS

Small, high-speed drills known by the trade name of "Blue Diamond" are being placed on the market by Whitman & Barnes, Inc., Detroit, Mich. These drills have been developed by the engineering and metallurgical departments of the company in close cooperation with the production shops of Detroit. They have been brought out with the object of reducing drill breakage, increasing production, and lowering tool and production costs. The drills are furnished in jobbers' sizes of from 1/16 to 1/4 inch in sixty-fourths of an inch, and in wire sizes from Nos. 1 to 55 inclusive.

RANSOM SNAGGING GRINDER TABLE

Two heavy-duty high-speed snagging grinders recently sold by the Ransom Grinding Machine Co., Oshkosh, Wis., were provided with a table of the construction illustrated. The top of this



Ransom Snagging Grinder Equipped with Table that Facilitates Working on Large Castings or Plates

table extends 16 inches back from the wheels and is approximately 85 inches long. The plates on the table top can be moved in and out to compensate for wear of the wheels. The table itself has a vertical adjustment that will more than take care of average needs. Holes may be drilled in the top to provide for pry-bars if required.

A table of this size and shape permits the grinding of large castings such as are ordinarily ground with a swing grinder. Edges of large steel plates may also be ground on machines equipped with this table.

BUFFALO HEAVY BILLET SHEARS

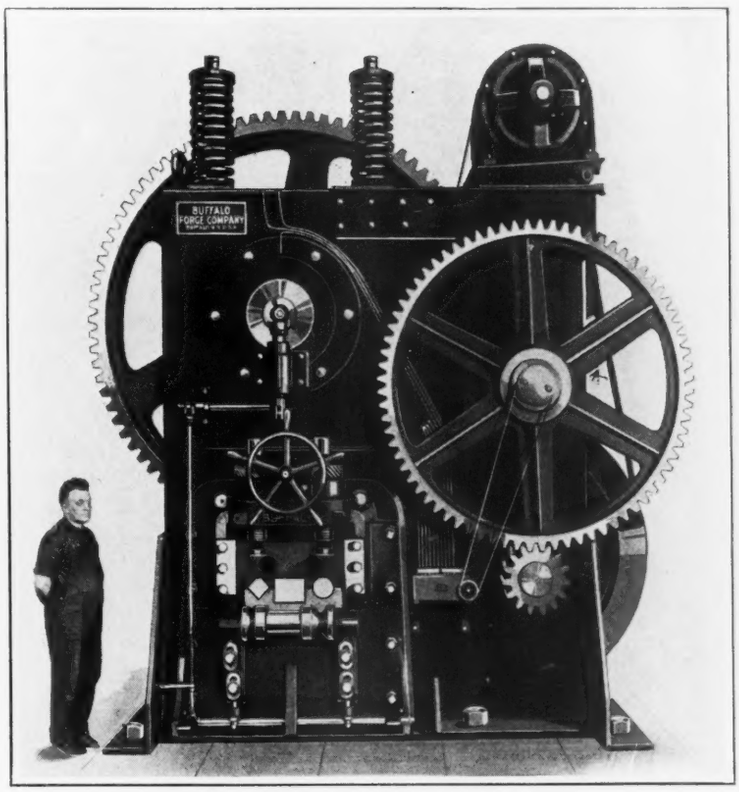
Billets of 0.15 per cent carbon steel up to 7 inches square or 7 3/4 inches round can be sheared by means of the machine here illustrated, which was recently built by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. This machine is constructed of high-carbon steel plates, which are joined by arc-welding heavy bars between them. All welded sections are under tension only. Heavy disks are welded to the rear frame at the points where the main and intermediate bearings are located, the rear frame being lighter than the front. The knife-holder, which is a steel casting, of one piece with the stripper holder, is welded to the frame, as are also the brackets.

The ram is an alloy steel casting, the end that engages the plunger being heat-treated for maximum wear. The knife seats in the plunger, front frame, and knife-holder are lined with hardened tool-steel pieces. A force-feed oiling system delivers lubricant to every bearing.

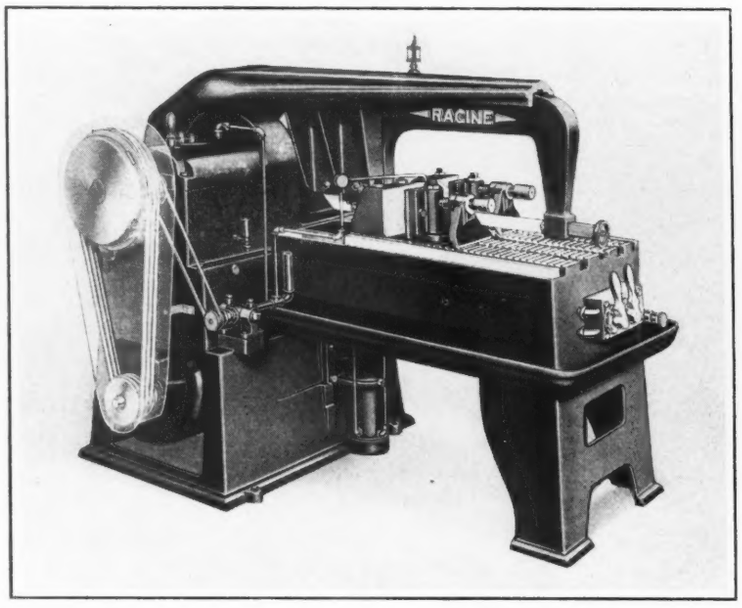
This machine can be tripped by hand or foot or locked for continuous operation. Attention is called to the fact that the stripper reaches close to the knives so that material can be used to the very end without undue waste. The machine is one of twelve sizes having capacity for bars from 1 inch to 8 3/4 inches.

RACINE HYDRAULIC POWER SAW

A power metal-cutting saw in which a number of functions, including the feed, are controlled hydraulically, has been brought out by the Racine Tool & Machine Co., 1752 State St., Racine,



Buffalo Billet Shears Constructed of High-carbon Steel Plates Welded Together



Racine Hydraulically Operated Metal-cutting Saw

Wis. This machine was designed to incorporate most of the desirable features of the positive-feed shear-cut production saw built by the concern and to possess the additional advantages obtained through the use of the hydraulic apparatus. The hydraulic feed is powerful and flexible to meet any metal-cutting requirements. The same blade can be used for thin-walled tubing or solid bar stock, the range of feeds permitting the proper cutting speed for any kind of stock.

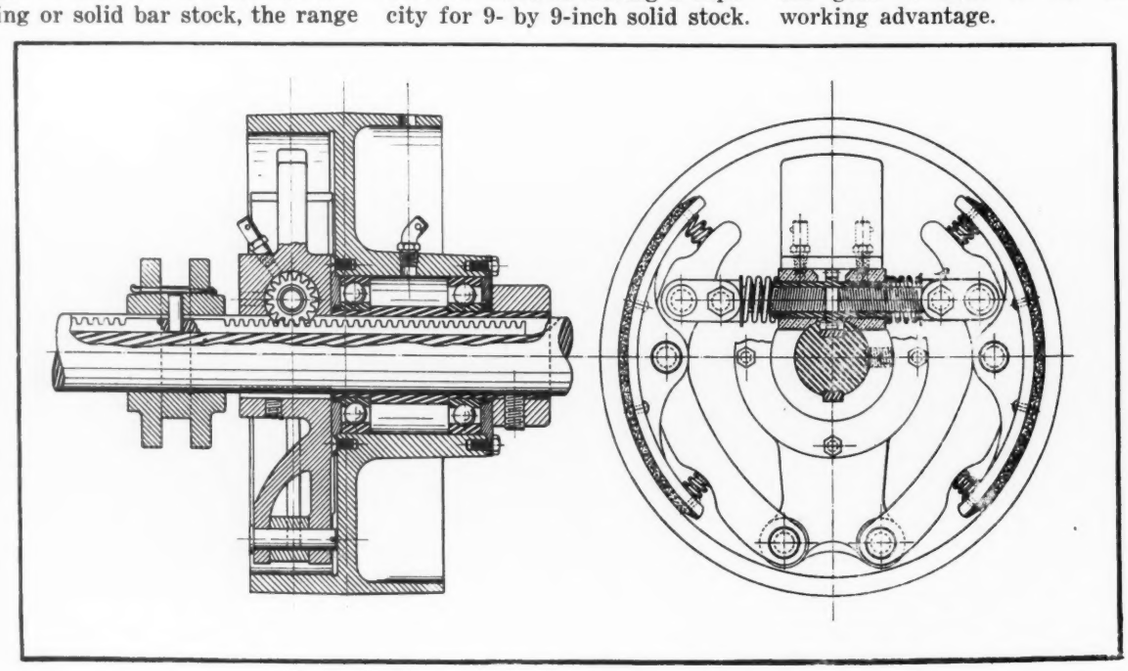
By means of the hydraulic equipment, the machine cuts faster at the beginning and end of a cut through round stock than it does at the middle. Thus, increased cutting speeds can be used. Long blade life is claimed because of a satisfactory lift on the non-cutting stroke. The machine is rated as having a capacity for 9- by 9-inch solid stock.

IMPROVED "DURO-FRICTION" CLUTCH

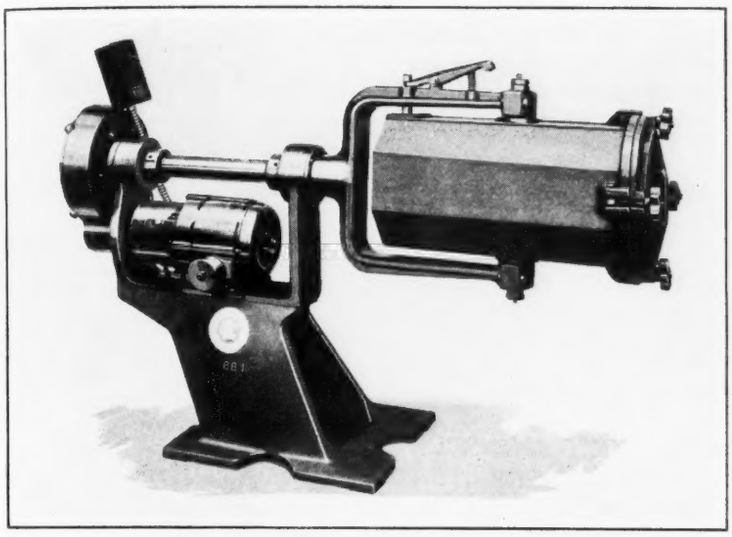
Various improvements have been incorporated in a new model clutch recently developed by the Duro-Friction Clutch Co., Grand Rapids, Mich. The construction of this clutch will be apparent from the accompanying illustration, where it will be seen that the friction contact is made at the greatest diameter of the driven pulley.

The friction shoes float on account of the fact that a spur gear engages a rack which has 5/16 inch of float on its working face. This construction enables the friction shoes to make positive contact at all times. Wear of the shoes is taken up automatically until these parts have been worn out. The Acme-screw expansion works on a compound leverage to increase the frictional contact. The shoes also float on a fixed center.

The driven ball-bearing pulley is mounted on a sleeve, so that it can be moved out of place readily should this be required. All wearing parts are casehardened. The face width of the spur gear which drives the two screws is 5/16 inch, and the width of the gear rack is 5/8 inch. The greater width of the rack allows the gear to float to its best working advantage.



"Duro-Friction" Clutch of Improved Construction



Crown Burnishing Machine Designed to Occupy Small Floor Space

CROWN MOTOR-DRIVEN BURNISHING MACHINE

A motor-driven burnishing machine of the construction here illustrated is being introduced to the trade by the Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill. The advantages claimed for this equipment are high economy of operation and large productiveness within a small working area. Since the machine is equipped with a motor drive, it can be placed in any convenient position in the shop without considering belting or shafting. The machine occupies a floor space of 66 by 30 inches, and has a net weight of 600 pounds.

LOSHBOUGH-JORDAN PRESS WITH INCREASED DIE SPACE

The Loshbough-Jordan Tool & Machine Co., Elkhart, Ind., now builds a No. 3 open-back inclinable press having a die space of 8 3/4 inches with the adjustment up and the stroke down to the top of the bolster plate. The capacity of the press is 22 tons. The crankshaft has a standard 2 1/2-inch stroke.

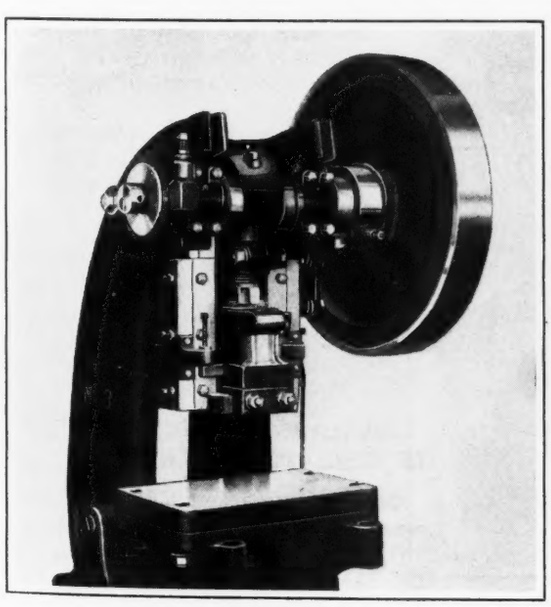
With the additional die space thus provided, this small press can be used advantageously on deep drawing jobs. Also, when a long-stroke crankshaft is to be used, the die designer has additional space for the set-up.

ELECTRIC ROTARY RETORT FURNACE FOR PRESSURE CARBURIZING

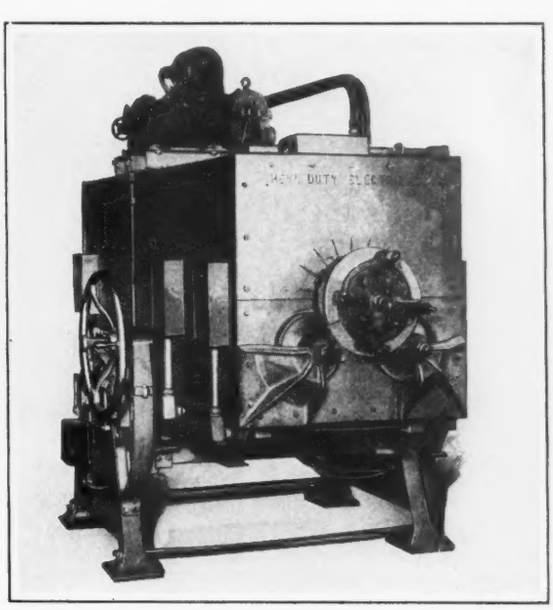
An electric furnace for pressure carburizing has been placed on the market by the Hevi Duty Electric Co., Milwaukee, Wis. This is of the rotary retort type licensed under United States patents by the American Gas Furnace Co. The furnace illustrated is of the 600-pound size, but furnaces are made in capacities up to 1200 pounds.

This furnace is constructed with a heavy outer steel shell which is reinforced and insulated. There is a mechanism that permits tilting the furnace backward and forward to facilitate charging and discharging. Insulated plugs that close the retort both at the front and rear are easily removed for loading and unloading.

Nickel-chromium heating elements are mounted on all four sides of the furnace chamber.



Loshbough-Jordan Press with Increased Die Space



Electric Rotary Retort Furnace for Carburizing

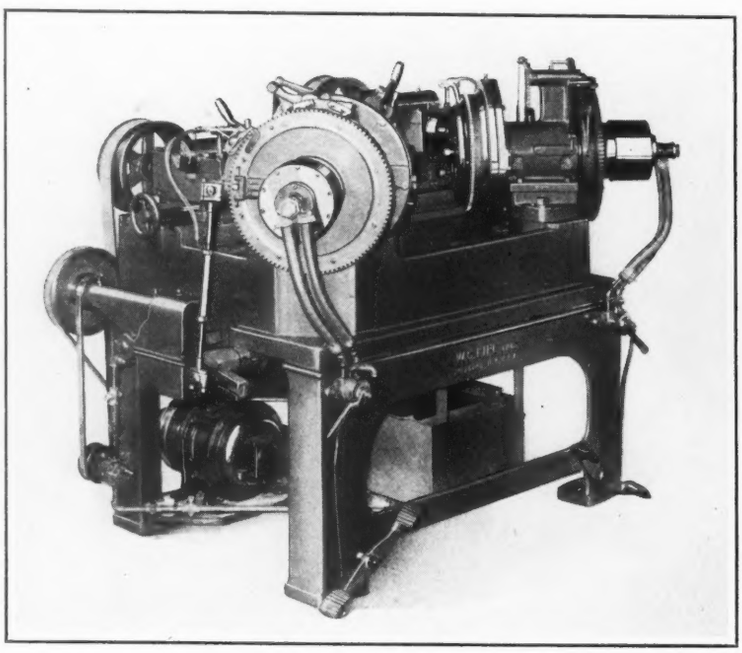
These are mounted in radiant-type refractories. "Pyrofax" gas under pressure is used normally in this furnace, but artificial and natural gas, as well as carburizing compound, can also be employed. With ordinary normalized carburizing steels, a penetration of 1/16 inch takes place in five and one-half hours at a temperature of 1675 degrees F.

LIPE FLYWHEEL RING-GEAR CHAMFERING MACHINE

Two ring gears of automotive engine flywheels are chamfered at one time in a double-spindle machine now manufactured by W. C. Lipe, Inc., 208 S. Geddes St., Syracuse, N. Y. In this machine, the ring gears are held in place by air chucks operated through foot-levers. The arrangement permits the operator to use both hands for loading and unloading, with the result that the average reloading time is 12 seconds.

A master index ring is used to insure accurate indexing for chamfering each tooth. For the chamfering, an internal form-ground hollow mill is employed. A flow of cutting lubricant is directed on the cut.

Ring gears can be chamfered at the rate of 80 teeth per minute on each spindle. One operator can handle two machines placed front to front, giving a production of approximately one hundred and fifty-two 110-tooth ring gears per hour. The machine is driven by two one-horsepower motors running at 1200 revolutions per minute. The net weight of the equipment including the motors is 3080 pounds.

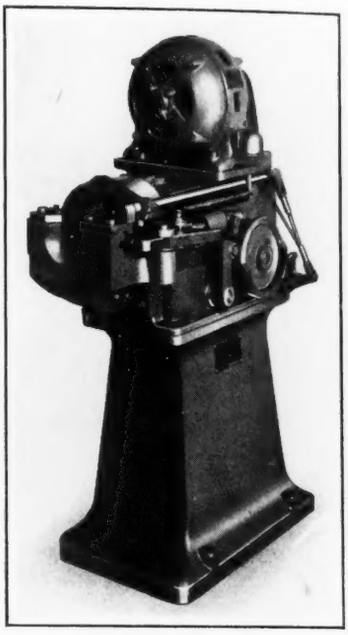


Lipe Double-spindle Machine for Chamfering Two Flywheel Ring Gears at a Time

KENT BOLT AND STUD POINTER

The pointing head of a semi-automatic bolt and stud pointer just developed by the Kent Machine Co., Cuyahoga Falls, Ohio, moves forward and backward a predetermined number of times per minute. Gears for obtaining from 25 to 60 points per minute are regularly furnished. The machine is built in two types, one having an arrangement for holding the bolt to be pointed by the head, while the other is provided with a double-jaw gripping attachment to suit round-head bolts, studs, or rods.

The reciprocating action of the cutter-head is effected by a cam which is driven by gearing from the cutter-spindle. This mechanism is contained within the body of the machine. The change-gears by which the number of reciprocations of the cutter-head are controlled are located on the outside of the machine.



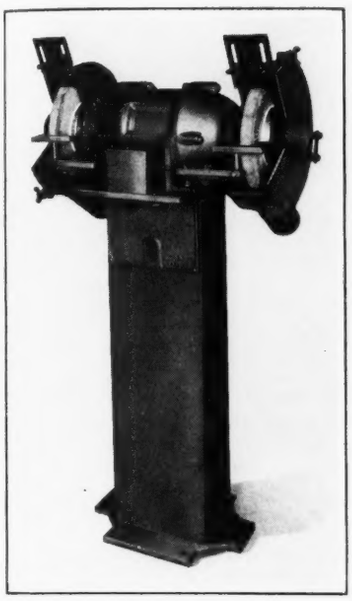
Kent Bolt and Stud Pointer

The gripping attachment for studs and similar parts is cam-actuated. This mechanism is furnished with a swinging stop for locating the end of the work in relation to the advanced position of the cutter-head. Two square tools are used in the cutter-head.

While this machine is designed especially for pointing, it can be adapted to end-drilling, shouldering, hollow milling, etc. Bolts up to and including 1 inch in diameter, and of any commercial length, can be pointed. The machine is built in bench and pedestal styles and with either a belt or motor drive.

GRINDERS AND BUFFERS OF STEEL CONSTRUCTION

Grinders and polishing lathes constructed of steel plate instead of cast iron wherever possible are being introduced on the market by the Production Equipment Co., 5213 Windsor Ave.,



Grinder with Welded Steel Pedestal

Cleveland, Ohio, under the trade name of "One Profit." This name has been selected because of the fact that the entire tool, including the motor, is manufactured in the plant of the concern. From the accompanying illustration it will be seen that the pedestal is constructed of steel shapes which are welded together to form a rigid support.

The fully enclosed motor requires no ventilation; this eliminates the danger of dirt being carried inside by the air. The spindle is mounted in ball bearings. Large oil reservoirs provide for cool bearing operation under all load conditions.

These grinders and buffers can be supplied in bench or pedestal types and in sizes ranging from 1 to 15 horsepower. The motor can be mounted in the head or in the base. The line includes multi-speed and selective-speed machines, snaggers, double-disk grinders, combination disk and standard grinders, and combination grinders and buffers.

LUFKIN RADIUS GAGE SETS

Additional sizes have been added to the line of radius gages manufactured by the Lufkin Rule Co., Saginaw, Mich., which were described in MACHINERY, July, 1929, page 875. The new sizes range from 9/32 to 1/2 inch, in increments of 1/32 inch, the line previously ranging from 1/32 to 17/64 inch in increments of 1/64 inch.

An advantage of these gages is that each one is a separate unit that can be conveniently applied to the work. Both internal and external forms are available on the same gage.

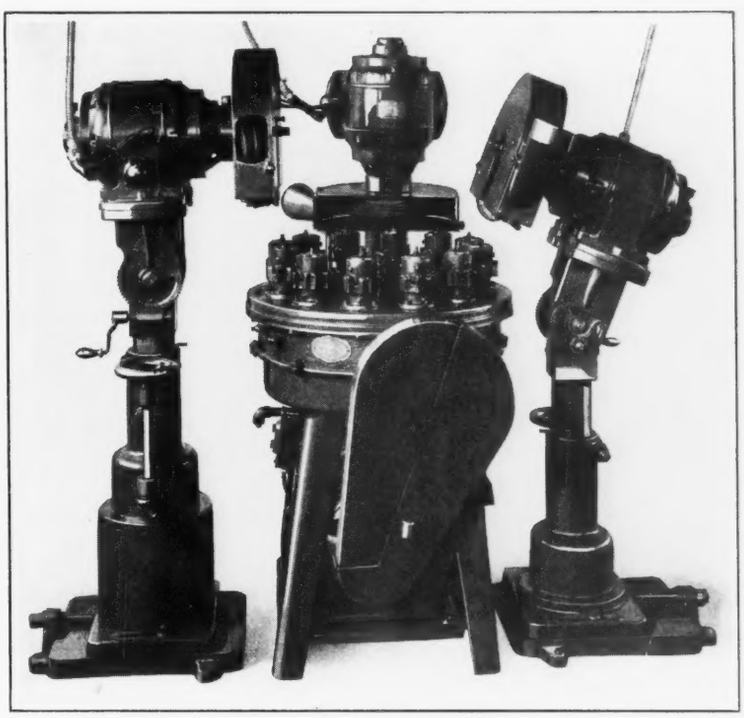
"CIPCO" AUTOMATIC POLISHING AND BUFFING MACHINE

An automatic polishing and buffing machine capable of performing three operations with but one handling of the work is being placed on the market by the C. I. Packer Tool & Die Co., Meriden, Conn. This machine is adaptable to many types of work. Because of the simplicity of the expansion chucks which hold the work, change-overs from one job to another require only a short time.

A multi-speed motor revolves the table with an intermittent action at four different speeds. The period of dwell—that is, the length of time that the work is in contact with the wheels—may be set to suit the nature of the work. Ample time is provided for the removal of finished work and for reloading when the spindles are at the front of the operator. At this point, the spindles pass over a cam which releases the work-holding fixtures. The entire mechanism is driven by gears submerged in a dustproof oil reservoir.

Three ball-bearing motor-driven adjustable wheel-heads can be so set that the wheels will come in contact with the work as the revolving expansion chucks advance into position. In the illustration, one of these wheel-heads is shown located on each side of the equipment and one at the rear.

The wheel-heads are adjustable for height by means of the handwheel on the side. There is also a 90-degree adjustment of the motor and buffing wheel from the horizontal to the vertical. This adjustment is obtained through worm-gearing. The wheel-head pedestal can be adjusted longitudinally by means of



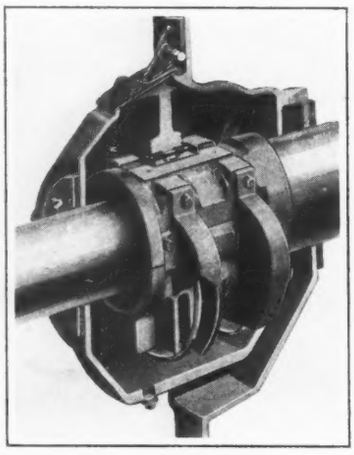
"Cipco" Automatic Polishing and Buffing Equipment

adjusting screws operating in the floor base. The motor can also be swiveled on the base to set the wheel diagonally in relation to the surface being finished.

LEAK-PROOF BEARINGS FOR LARGE WESTINGHOUSE MOTORS

Large motors built by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., are now equipped with a split sealed-sleeve bearing in which the oil-rings and other sources of oil spray are fully enclosed at all points above the level of the oil in the reservoir. As may be seen from the illustration, the enclosures form part of the bearing itself. The air space within the housing around the bearing is thus entirely separated from the chambers in which the oil-rings turn, so that during operation of the bearing, as well as through periods of rest, the air in this space is entirely free from oil spray.

The interior walls of the housing remain quite dry, and leakage through and along the crevice between the two halves of the bearing housing is prevented completely. Even leakage induced by winding is avoided, for although a current of air may pass through the housing as induced by the suction of the blower, it cannot carry oil spray and vapor out of the housing because the air in the housing is dry and clean.

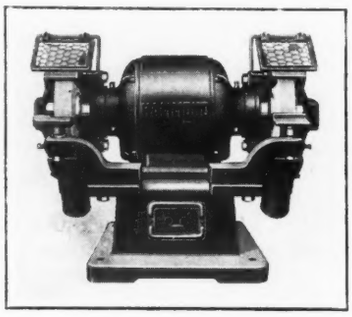


Westinghouse Split Sealed-sleeve Bearing for Large Motors

HAMMOND BENCH-TYPE ELECTRIC GRINDERS

Bench-type electric grinders of 1 1/2- and 2-horsepower capacity are being placed on the market by Hammond Machinery Builders, Inc., Kalamazoo, Mich., for general-purpose tool and light production grinding. These grinders are of the same construction as the larger machines manufactured by the company in sizes up to 10 horsepower. The motor is totally enclosed and has a push-button control which is conveniently mounted on the pedestal. A Cutler-Hammer automatic starter inside the pedestal protects the motor from overload, low voltage, and phase failure.

Standard equipment includes steel wheel guards which can be

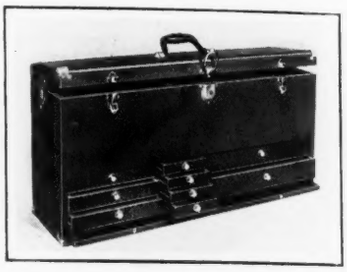


Hammond Electric Grinder Made in 1 1/2 and 2 Horsepower Sizes

adjusted to compensate for wheel wear, the same distance being maintained between the wheels and the guards. Outlets are furnished for convenience in attaching the guards to an exhaust system. The 1 1/2-horsepower size takes grinding wheels 10 inches in diameter by 1 1/2 inches face width; and the 2-horsepower size takes wheels 12 inches in diameter by 2 inches face width. These grinders can also be supplied in floor types.

GERSTNER TOOL CHEST

A tool chest designed for machinery repair and maintenance men has been brought out by H. Gerstner & Sons, 277 Columbia St., Dayton, Ohio. This chest has a deep top compartment measuring 30 inches in length and 8 1/4 inches in height on



Gerstner Tool Chest for Maintenance Men

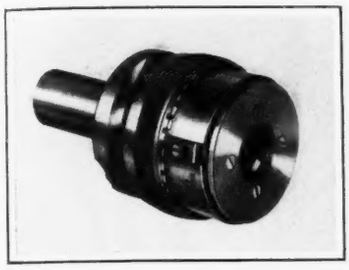
the inside. A removable rack is provided for holding saws and a square when these tools are required. There is also an assortment of drawers measuring 4 1/4, 8 1/2, and 14 1/4 inches long inside, respectively, and ranging from 7/8 to 2 inches in height.

The chest is finished with a waterproof covering, nickeled trimmings, and quartered-oak drawer fronts. The front lid slides on steel bearings under the bottom drawer. It swings up and locks automatically when the top lid is down.

RICKERT-SHAFER AUTOMATIC SELF-OPENING DIE-HEAD

A Model C automatic self-opening die-head of the revolving type is being introduced on the market by the Rickert-Shafer Co., Erie, Pa., primarily for use on automatic screw machines and chucking machines. The body and shank of this die-head are made in one solid piece with a view to insuring concentricity. A tongue-and-groove joint is employed to hold the chasers against the retainer—a construction for which the advantages of positive action and accurate threads at all times are claimed. The chaser retainer is made in two pieces so as to permit accurate grinding of the angular surfaces.

By means of the deep notches on the adjusting ring and the sturdy pawl being recessed into the retainer, these two members are locked as an integral part. The die-head is locked in the threading position by two tripdogs which are located diam-



Rickert-Shafer Die-head of the Automatic Revolving Type

etrically opposite each other and prevent cramping.

The chasers can be removed and replaced with ease. Lifting the latch with the thumb or index finger causes the trip-ring to spring back and carry the chaser retainer with it. The chasers are then free to be withdrawn from the slots. This die-head is made in six sizes for cutting straight threads from 1/16 to 1 1/2 inches in diameter and pipe threads up to 1 inch.

OSTER MOTOR-DRIVEN PORTABLE THREADER

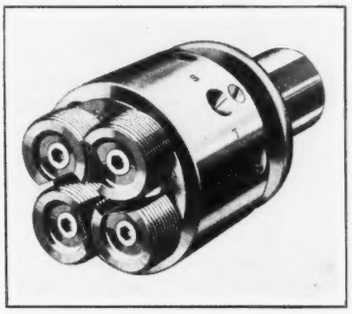
All the "Willie-Williams" portable power threaders made by the Oster Mfg. Co., Cleveland, Ohio, and the Williams Tool Corporation are now equipped with "Domestic" electric universal motors. These motors were formerly provided on the Oster "Power Boy" threader only. It is claimed that this new motor drive not only speeds up the production of the machine, but also eliminates any tendency toward stalling, since the speed of the motor is in direct proportion to the pull on the dies. These portable power threaders can be furnished in either bench or pedestal types for threading, cutting, reaming, and chamfering all sizes of pipe from 1/4 to 2 inches.

"NAMCO" REVOLVING-TYPE OPENING DIE-HEADS

A line of "Namco" Style DR opening die-heads of the revolving type has been brought out by the National Acme Co., Cleveland, Ohio, for use in automatic screw machines and other machine tools having live or rotating spindles. These dies have only three major parts, the body, cup, and adjusting plate. They are equipped with circular chasers which give unusually long life and permit long runs between grinds.

The chasers are accurate circular thread-forming tools and are mounted on quickly removable blocks, the faces of which are ground to the helix angle of the thread. The chasers are located by means of serrated steel buttons and each one is held to its block by a hollow set-screw.

Close-to-shoulder threading is possible with these circular chasers, and the positive action of the die-head in opening makes this practice safe. Tripping and resetting are accomplished by an outside fork or an inside trip or by a combination of both. The



"Namco" Opening Die-head with Quick-removable Circular Chasers

die-heads are manufactured in six sizes ranging from a minimum capacity of 3/16 inch up to a maximum capacity of 2 3/8 inches.

"LIGHTWELD" WELDING ELECTRODE

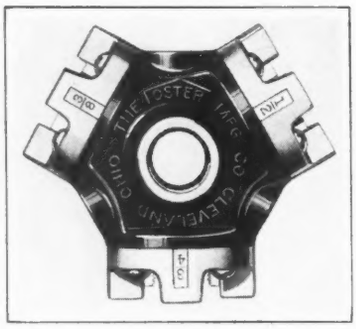
The Lincoln Electric Co., Cleveland, Ohio, has brought out a welding electrode known as "Lightweld" for use on light gage material. It can be used on material of Nos. 16, 18, 20, or 22 gage in making lap, butt, or corner welds. It was designed to be used with a manual carbon arc and with from 30 to 60 amperes direct current. It is applicable for horizontal, vertical, or overhead welding. The rod is 1/16 inch in diameter by 30 inches long, and is put up in 10-pound containers.

The carbon used with this electrode should be 5/32 inch in diameter, tapered gradually from a sharp point back about 1 1/2 inches, and should be gripped in the holder about 2 inches from the point. A head shield should be used by the operator so as to leave both of his hands free. The carbon in a holder should be held in one hand and the electrode in the other. The electrode should be held directly over the seam with the end of the wire tight down against the sheet, while the carbon should be held at an angle of about 60 degrees to the sheet and pointed in the direction of the welding.

STEEL CABINET FOR SMALL TOOLS

A steel cabinet recently brought out in four types by the All-Steel-Equip Co., Aurora, Ill., is intended for use in storing and safeguarding drills, reamers, and other small expensive tools, either inside or outside the tool-room. All four types have angle- and channel-iron frames with substantial body members for sustaining heavy weights. The standard equipment includes six sloping shelves with five adjustable partitions in each, and one horizontal shelf near the bottom. All shelves are adjustable and hold the tools in plain sight. One cabinet model, provided with locking doors, is especially suitable for use in instances where tools are stored outside the tool-room.

Steel Cabinet Designed for Storing and Safeguarding Tools



Oster Three-way Threader for 3/8-, 1/2- and 3/4-inch Pipe

OSTER THREE-WAY THREADER

A three-way threader for 3/8-, 1/2-, and 3/4-inch pipe has just been placed on the market by the Oster Mfg. Co., Cleveland, Ohio, and the Williams Tool Corporation. This device will cut a standard length thread on pipe as close as 4 5/8 inches to a wall. It uses the same open-type die-holders as the regular "Chip Chasers" made by this concern. The equipment is small and light and is provided with a 3/4-inch handle.

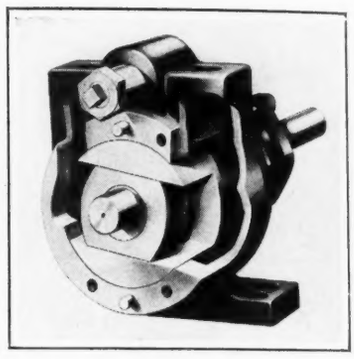
BELLEVUE TOOL BRAZING FURNACES

High-temperature electric furnaces, intended for such operations as the brazing of tungsten-carbide tools and the hardening of high-speed steels, have recently been developed by the Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit, Mich. These furnaces are equipped with "Globar" electric heating elements and with a "Sillimanite" hearth. The furnace shown in the illustration has an effective hearth 6 inches wide by 12 inches deep, and may be operated at a maximum temperature of 2450 degrees F. Bench- and floor-type units are available. They can be provided with a new atmospheric control for which a patent has been applied. In the illustration, an observation shield is shown in front of the opening.

"ROTAPISTON" PUMP

The "Rotapiston" pump, which is being placed on the market by the Globe Products Co., Cleveland, Ohio, combines the high suction lift and discharge characteristics of piston type pumps with the simplicity and compactness of the rotary type. For this reason, and because it needs no priming, the pump is particularly adapted for use where instant action and reliability are essential. Among the uses for which it is suitable may be mentioned the circulation of cutting oil for machine tools, the pressure feed of fuel to oil burners, and the forced lubrication of machine bearings.

The pump is available in three sizes rated at 1/2, 1, and 2 gallons, respectively, for each 100 revolutions of the drive shaft.

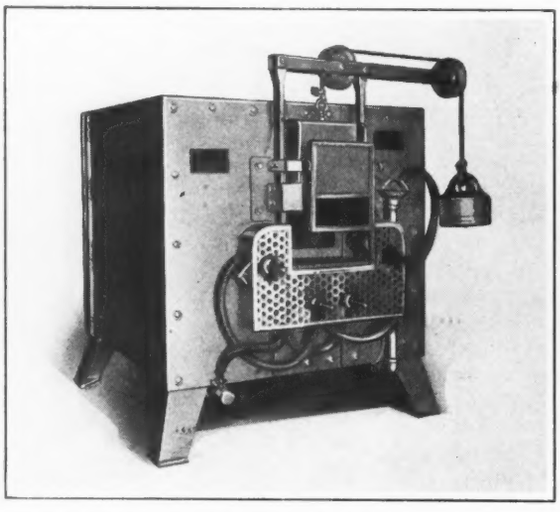


"Rotapiston" Pump Made in Three Sizes by the Globe Products Co.

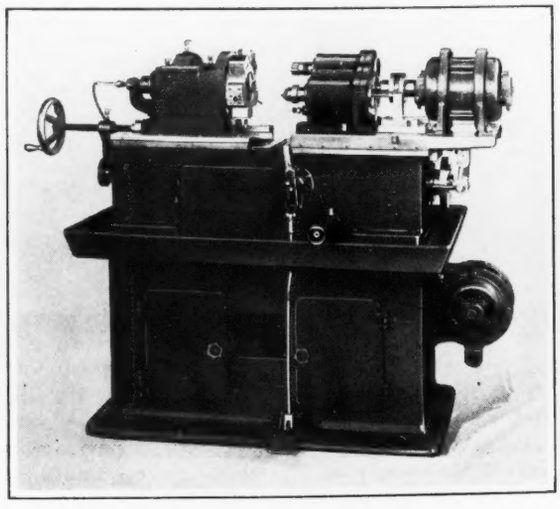
There are only four moving parts —the camshaft, two pistons, and the rotor. The camshaft is placed slightly off center in relation to the rotor, and the rotation of the cam causes the two pistons to move back and forth in the rotor. Each face of the pistons is presented to the discharge and suction ports in succession.

LANGELIER SEMI-AUTOMATIC MACHINE

The semi-automatic machine here illustrated has been built by the Langelier Mfg. Co., Providence, R. I., for turning, facing, spotting, drilling, and necking the stem winding post on wristwatch frames. This machine has an output of twelve pieces per minute. It can be operated continuously or tripped and stopped after each cycle.



Bellevue Electric Furnace Suitable for Brazing Tungsten-carbide Tools



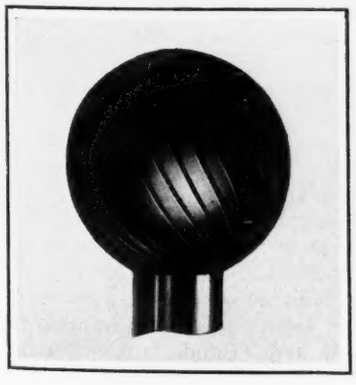
Langelier Machine Designed for Performing Operations on the Stem Winding Post of Watch Frames

The machine is equipped with a traversing saddle on the right-hand end of the bed on which a housing is mounted that carries four horizontal spindles. These spindles are driven by a one-horsepower motor which is also mounted on the saddle. The first spindle is fitted with a box-tool having two cutters, one of which is used for turning the watchcase stem and the other for facing the end. The second spindle is equipped with a starting drill and the third with a drill for producing the hole through the center of the stem. The fourth spindle is of a special construction and is employed to hold a tool for turning a neck on the stem.

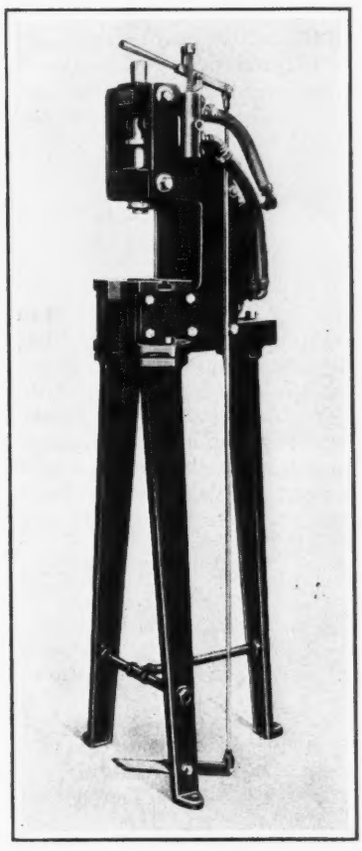
The saddle, with the spindle housing and the motor as one unit, is operated toward the work-holding turret on the left-hand end of the machine, by means of a cam mounted on a shaft on the inside of the bed. The work-holding turret has five quick-clamping fixtures which are indexed through a pair of spur gears and a Geneva motion. The turret is locked in each indexed position by a tapered spring plunger which is actuated by a cam. Compressed air is used for blowing small chips out of the fixtures. This machine weighs approximately 2000 pounds.

"PROFILO" ROTARY BALL FILES

A line of coarse-flute rotary ball files from 1/4 to 1 inch in diameter has been added to the products of the Rotary File Co., 6351 Brush St., Detroit, Mich. These files are intended for finishing metal patterns, molds, etc., to different radii without the necessity of scraping. Generated helical flutes are provided on the files, as shown in the illustration. It is claimed that the generated flutes give unusual accuracy in machining, and the helical form produces smooth surface finishes.



Rotary Ball File for Finishing Parts to Different Radii



Hopkins Air-operated Press of the 1000-pound Size

HOPKINS AIR-OPERATED ARBOR PRESSES

Air-operated arbor presses in 1000-, 4000-, 6000-, and 12,000-pound sizes are now being manufactured by the Tomkins-Johnson Co., Jackson, Mich. The illustration shows the 1000-pound size. These presses may be furnished for operation by hand or foot.

The sides of the presses are made of steel plates. In the end of the ram there is a hole provided with set-screws so that punches or assembling tools can readily be bolted to the ram. Tools can also be secured to the table by means of the T-slots. Adjustments of the ram are made by using U-washers of suitable thicknesses.

These presses are operated by Hopkins tubular-type air cylinders. The size of the cylinder can be changed on all presses to increase or decrease the pressure.

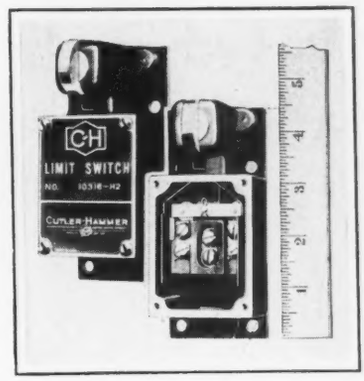
MOTOR-DRIVEN COUNTERSHAFT

A motor-driven countershaft that can be mounted on any cone-pulley driven machine tool to obtain the advantages of an individual motor drive has been brought out by the Production Equipment Co., 5213 Windsor Ave., Cleveland, Ohio. The unit consists of a normal-speed, semi-enclosed motor having an integral planetary gear reduction which is contained in an oil-tight housing. This gear reduction provides a countershaft speed as low as 50 revolutions per minute or as high as 550 revolutions per minute. A push-button for controlling the motor and a belt shifter are conveniently located.

The driving cone-pulley is supported by an outboard ball-bearing pillow block. A ball-bearing idler pulley maintains a large belt wrap on the driven and driving pulleys. These pulleys are spaced at center distances of from 18 to 24 inches only.

CUTLER-HAMMER SMALL LIMIT SWITCH

A single-pole limit switch of the construction illustrated has been brought out by Cutler-



Cutler-Hammer Limit Switch for Machine Tools, Conveyors, etc.

Hammer, Inc., 1204 St. Paul Ave., Milwaukee, Wis., for general service on machine tools, conveyors, and other equipment. The switch starts the motor and stops or reverses it at the limits of travel.

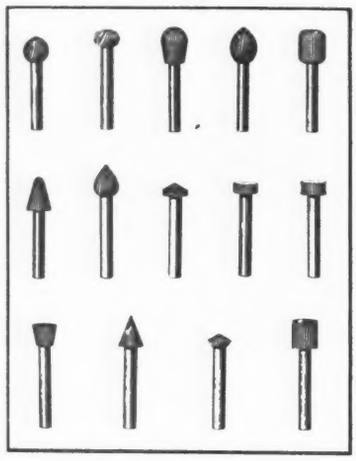
Two types of this switch are furnished—one with normally closed contacts which are opened when the operating roller is depressed, and the other with normally open contacts which are closed when the roller is depressed. Double break contacts with silver-rivet contact tips reduce pitting and insure long life.

KELLER MILL-CUT BURRS

The Keller Mechanical Engineering Corporation, 74 Washington St., Brooklyn, N. Y., is bringing out a line of mill-cut burrs in the fourteen shapes illustrated. These burrs supplement the regular line of 1/4- and 1/2-inch file-cut burrs made of high-speed steel and the standard line of mill-cut burrs made by this concern. These burrs, like those in the other lines, have a 1/4-inch shank. Their maximum diameter is approximately 1/2 inch.

These tools are designed to produce a smooth finish on die steels, but they can be used on aluminum, brass, bronze, copper and other soft metals without clogging. They can also be employed on wood, plaster, leather, and horn.

The burrs are made of one piece of steel, machined and milled between centers, and ground after hardening. They are adapted for use with all kinds of flexible shaft equipment, portable drills, and stationary machines.



Fourteen New Shapes of Keller Mill-cut Burrs

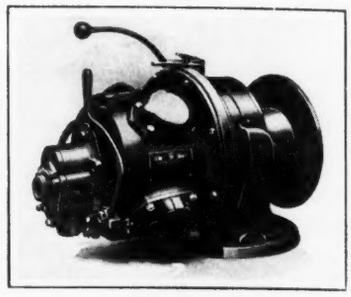
NIAGARA IMPROVED LIGHT PRESS

An improved No. 101 power press for light stamping jobs has been placed on the market by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. As shown in the illustration, provision has been made for the quick attachment of a motor bracket. This machine is the smallest press in the Niagara line. It is rapid acting and is particularly convenient for light punching and forming operations in making buttons, small electrical pieces, jewelry, trimmings, and similar articles.

Light Niagara Press with Provision for Attaching a Motor

The motor bracket carries a self-adjusting ball-bearing idler to keep the driving belt under the proper tension and increase the arc of belt contact on both the pulley and the flywheel. The bracket is of welded steel construction. It is carried in stock for quick application to machines.

This press can be furnished for bench use or with a table for floor use. A bolster plate or die-holder can be supplied as optional equipment.



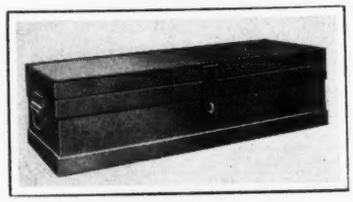
"Utility" Air Hoist of 2000 Pounds Capacity

INGERSOLL-RAND PORTABLE AIR HOIST

A "Utility" portable air hoist of 2000 pounds capacity has been added to the line manufactured by the Ingersoll-Rand Co., 11 Broadway, New York City. This hoist is driven by a radial four-cylinder air motor of the reciprocating piston type. All wearing parts and the cylinders are easily renewable, and the cylinders are also interchangeable. Ball and roller bearings are used at points where they add to the efficiency and life of the hoist. A clutch of the positive jaw type is used to disengage the motor. This clutch is thrown out by an eccentric shaft controlled by a lever on top of the hoist. The brake lever can be adjusted to six positions.

STEEL TOOL CHEST

A large and heavy tool chest designed for workmen who must carry a complete set of erection tools to each job is shown in the accompanying illustration. This chest is a recent product of the All-Steel-Equip Co., Aurora, Ill. It is made of No. 14 gage steel, and is equipped with handles on each end. Bands on the top and bottom and around the cover act as reinforcements. A hasp and staple permit padlocking.



Tool Chest Designed Especially for Erection Men

Baker-Case Machinist's Chest

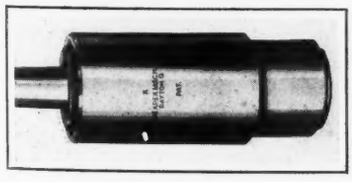
BAKER-CASE MACHINIST'S CHESTS

Eight new models of machinist's chests have just been placed on the market by the Baker-Case Mfg. Co., Inc., Racine, Wis., in both leatherette and quarter-sawed oak finishes. These chests are equipped with steel drawer runners. Another feature is the riveted nickel-plated drawer pulls. Leather handles with an inner steel reinforcement are provided. The drawers are hand-fitted and the lock corner construction is used on all chests.

The illustration shows a style that is made in two sizes which measure, respectively, 17 by 9 by 12 inches and 20 by 9 by 12 inches, outside. The hinged front lid of the chest swings up and locks automatically.

APEX LARGE SIZE FRICTION CHUCK

Taps from 1 1/2 to 3 inches can be used in a friction chuck

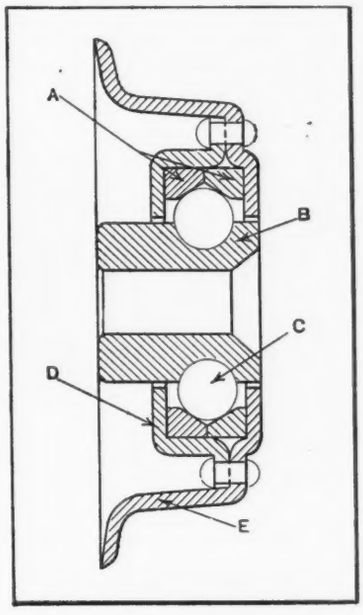


Apex Friction Chuck for Driving Taps, Studs, and Nuts

which has been brought out by the Apex Machine Co., Dayton, Ohio, primarily for tapping large size bottom holes in one operation and for setting studs and nuts of corresponding sizes. The chuck is intended for use in shops where heavy machines, large compressors, gas engines, and locomotives are built.

This large size chuck is of the same patented design as the smaller friction chucks made by the concern. The taps are held by means of free floating collets, which permit the tap to follow the hole. Both the tap and the collet are driven by the square, standard hand taps being used in this chuck.

The body of the chuck is 5 inches in diameter and 7 1/2 inches long. It is furnished with either a No. 5 or a No. 6 Morse taper shank as standard, but special shanks can be provided to suit requirements.



Construction of Matthews Ball-bearing Trolley Wheel

MATTHEWS I-BEAM TROLLEY WHEELS

Ball-bearing trolley wheels intended for use on structural I-beams are being introduced to the trade by the Matthews Mfg. Co., Worcester, Mass. As shown in the illustration, there are two separate outer ball races *A* of a patented construction. These races are made from open-hearth cold-rolled strip steel, carburized and casehardened. The inner race *B* is made of open-hearth cold-rolled rod, carburized and casehardened. Balls *C* are made of chromium steel, hardened and ground.

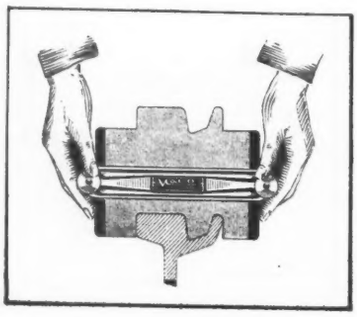
The separate inner retaining member *D* is pressed from heavy-gage open-hearth hot-rolled strip steel, and is not hardened, in order that it may withstand shock loads. Tire *E* is also pressed from open-hearth hot-rolled strip steel. It is designed to withstand loads in excess of the bearing capacity and because it is separate from the ball races, the tire can be heat-treated to suit its function.

FOLDING STEEL HORSE

A folding steel horse in which standard sized lumber is used as a rail is being introduced on the market by the Toledo Pressed Steel Co., Toledo, Ohio, primarily for use in steel mills, machine shops, and foundries. From the illustration it will be seen that the metal cross-member of the horse is of a toggle design which is clamped down to make jaws at the top of the horse that grip the wooden rail tightly. When taken down, the horse can be folded up compactly, so as to facilitate storage.

This horse may be used for temporary benches, scaffolds, and miscellaneous supports. It is suitable for use in assembly lines or beside machine tools for supporting work. It is made in eight heights from 18 to 60 inches, inclusive, and in different models which take wooden rails 1 or 2 inches thick, on edge, or 2- by 8-inch rails flat. A pair of 25-inch horses weighs only 24 pounds.

Setting up the Toledo Folding Steel Horse



Using the Maco Templet to Obtain the Contour of a Rail

MACO ADJUSTABLE TEMPLET

An adjustable templet composed of many fine strips of hard drawn brass held in an aluminum frame or housing is being introduced on the market by the American Maco Template Co., Inc., 44 Whitehall St., New York City. Each brass strip is 0.007 inch thick. These laminations are held in position by two clamps which are fitted with sections of corrugated rubber.

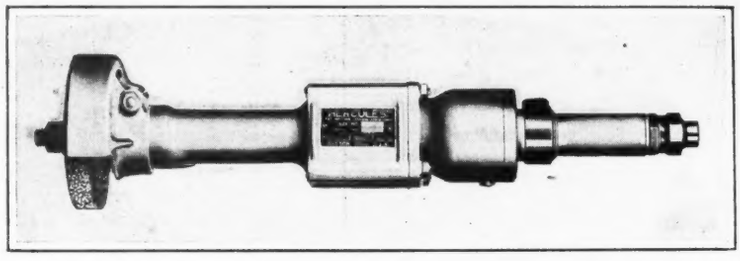
When an exact templet of any profile is required, all that is necessary is to loosen the screws and gently press the device against the contour. The result is a true outline of the surface against which the laminations are pressed, as indicated in the illustration. When the outline is complete, the laminations are held in position by merely locking the screws. From the templet thus produced, permanent templets can be made or a record of the profile may be filed for future reference.

This templet is intended for use in tool lay-out and design, inspection, patternmaking, diesinking, etc. It is convenient for checking new work or for determining the outline of worn parts. Three types are made which have a length of 6, 9, and 12 inches, respectively.

HERCULES PNEUMATIC GRINDERS

Two portable pneumatic grinders have been added to the No. 300 series manufactured by the Buckeye Portable Tool Co., Dayton, Ohio. Both models are of the same design, but the No. 320-3 has a speed of 6000 revolutions per minute and uses either a 4-inch vitrified wheel or a 6-inch high-speed wheel, while the Model No. 323-3 has a speed of 9000 revolutions per minute and uses a 4-inch high-speed wheel or various small cone and pencil grinders.

These grinders are of the same general construction as the one described in MACHINERY, April, 1929, page 633, which takes 6- and 8-inch wheels. The new grinders are 18 inches long over-all and 3 inches in diameter, the small size making them applicable in close quarters.



Hercules Pneumatic Grinder Made in Two Models which Run at 6000 and 9000 Revolutions per Minute

HANDLING MATERIALS IN A LARGE PLANT

The tremendous quantities of materials that are handled in a large manufacturing plant were referred to by J. I. McCormick, superintendent of the plant planning and lay-out department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in a paper presented before the Materials Handling Division of the American Society of Mechanical Engineers. In this paper Mr. McCormick mentioned that the shipments from the Westinghouse plant at East Pittsburgh last year averaged 5600 tons a month, and that each part had to be handled, on an average, seven times between operations, which meant that 39,200 tons of materials, in all, are handled each month.

In addition to this, there is the scrap, making a total of over 42,000 tons of materials handled. This tonnage does not include coal, ashes, incoming maintenance material, or machinery used in the company's plant. The latter items alone amount to about 70 carloads a month. From these figures it will be quite evident that the materials handling problem in a large plant is a very real one, and that materials handling must be studied just as carefully and with as much judgment and attention to details as the machining problems.

* * *

INDUSTRIAL MACHINERY EXPORTS IN 1929

Complete statistics now available show that the exports of industrial machinery from the United States in 1929 exceeded all previous records except that of 1921. The total value of industrial machinery exports amounted to $257,085,000. As usual, Canada was the largest purchaser of equipment of this kind, followed by the United Kingdom. The third largest customer was Soviet Russia—Mexico, France, Argentina, Venezuela, Japan and Germany following in the order mentioned. The exports to Soviet Russia amounted to $13,738,000. Despite the fact that shipments to Latin America were the largest in many years, the exports to Europe exceeded those to Latin America.

Exports of American construction machinery in 1929 were valued at $16,371,000, representing a gain of 19 per cent over the shipments of the previous year.

PERSONALS

C. J. BOWERS has been appointed production manager of the Lincoln Electric Co., Cleveland, Ohio.

SLOAN HESS, formerly with H. W. Petrie, Ltd., Toronto, Canada, has become sales manager of the International Machinery & Supply Co., Hamilton, Ont., Canada.

S. GRIFFITH has recently been elected president and general manager of E. C. Stearns & Co., Syracuse, N. Y., manufacturers of small tools and hardware specialties.

J. I. BERNITZ, machine tool dealer, has moved from 25 Beaver St., New York City, to larger quarters at 47-49 West St., where facilities are available for exhibiting machines.

DR. ROBERT J. ANDERSON has resigned as vice-president and director of the Fairmont Aluminum Co., Fairmont, W. Va. He has not yet announced his plans for the future.

E. A. DOYLE, consulting engineer of the Linde Air Products Co., 30 E. 42nd St., New York City, was elected president of the American Welding Society at the annual meeting in April.

HENRY D. SHARPE, president and treasurer of the Brown & Sharpe Mfg. Co., Providence, R. I., has been elected a member of the board of directors of the United States Chamber of Commerce.

RALPH R. NEWQUIST has been appointed sales engineer of the Chicago office of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of alternating- and direct-current motors.

CARL A. JOHNSON, president of the Gisholt Machine Co. and president of the National Machine Tool Builders' Association, has recently been elected a director of the United States Chamber of Commerce.

GEORGE E. RANDLES, president of the Foote-Burt Co., Cleveland, Ohio, manufacturer of drilling machines and special machinery, sailed from New York on the S. S. *Mauretania*, May 21, for a two months' business trip in Europe.

E. A. CLARK, sales engineer of the Philadelphia office of the Reliance Electric & Engineering Co., has been advanced to the engineering department in Cleveland, where he will be engaged in the design of direct-current motors.

WILLIAM J. GRAHAM, vice-president of the Equitable Life Assurance Society of the United States, was elected president of the American Management Association at its Spring meeting held at the Hotel Astor, New York City, May 12 to 14, 1930.

PAGE GOLSAN, until recently vice-president of the Great Western Portland Cement Co. of Kansas City, Mo., has been appointed manager of the new business department of the engineering organization of Ford, Bacon & Davis, 39 Broadway, New York City.

ALBERT SHAW has been added to the Salt Lake branch office sales force of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Mr. Shaw will specialize on the coal and metal mining industries throughout the Salt Lake branch office district.

L. M. JORDAN has been appointed sales representative in the South Bend, Ind., district, of the Hevi Duty Electric Co., Milwaukee, Wis. Mr. Jordan was in the service of the Studebaker Corporation for eighteen years, investigating chemical and metallurgical processes.

HAROLD F. KNEEN has been appointed plant superintendent of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders. Mr. Kneen went to the Lincoln Electric Co. as assistant plant superintendent in June, 1929. He graduated in mechanical engineering from Cornell University in 1925. Previous to going to the Lincoln Electric Co. he held positions as superintendent of the Ironton, Ohio, plant of the Indiana Flooring Co. and as engineer with the Ingersoll-Rand Co.

Harold F. Kneen

JAMES C. ELVERSON has been made general manager of the American Viscosimeter Co., Inc., a subsidiary of the General Motive Control, Inc., 110 E 42nd St., New York City. Mr. Elverson has been general manger of the industrial division of the Motometer Co. since 1920.

CLYDE C. WHIPPLE, assistant professor of electrical engineering at the Polytechnic Institute of Brooklyn, has been granted leave of absence for one year to serve as visiting professor in electrical engineering at the Green School of Engineering of Princeton University.

JOHN C. ARDAGH, R. A. KYLE, AND ROBERT NEWTON have been transferred from the manufacturing division of the Lincoln Electric Co., Cleveland, Ohio, to the welder service division. Mr. Ardagh will be located in the Monadnock Building, Chicago, Ill.; Mr. Kyle at 136 Liberty St., New York City; and Mr. Newton at Cleveland.

L. W. HAYDEN has been appointed resident engineer in Philadelphia, Pa., for the Hevi Duty Electric Co., Milwaukee, Wis. He will have charge of the eastern territory of Pennsylvania, Maryland, Virginia, Delaware, District of Columbia, and the southern part of New Jersey. Mr. Hayden was formerly engineer with the Western Cartridge Co.

CHARLES A. CARPENTER, who has been engaged in the sale of industrial equipment in the Pittsburgh district for several years, has opened an office in the Park Building, Pittsburgh, Pa., where he will represent a number of leading manufacturers of chemical, hydraulic, and rubber mill equipment, special machinery, machine tools, steam specialties, and heating equipment.

J. C. DAVIS, purchasing agent for the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of alternating- and direct-current motors, has been elected president of the Purchasing Agents Association of Cleveland. Mr. Davis has been identfied with the Association for a long time, and has been purchasing agent of the Reliance Electric Co. for the last fifteen years.

C. D. MCCORMICK, formerly assistant advertising manager of the C. F. Pease Co., 822 N. Franklin St., Chicago, Ill., manufacturer of blueprint machinery, blueprint paper, drafting room furniture, etc., has been appointed advertising manager, succeeding W. L. EARL PASHLEY, now vice-president and assistant sales manager. Mr. McCormick has been with the company for over four years, and was previously connected with the Illinois Glass Co., Alton, Ill.

J. B. GILLHAM and G. A. ANDERSON of the Reliance Electric & Engineering Co., Cleveland, Ohio, have been sent to the Los Angeles and San Francisco offices, respectively, of the Utilities Equipment Corporation where they will handle the sales of Reliance alternating-current and direct-current motors. The Utilities Equipment Corporation is sales and service representative for the Reliance Electric & Engineering Co. on the Pacific Coast.

CHARLES D. MCCALL is now connected with Manning, Maxwell & Moore, Inc., in charge of sales of Putnam machine tools in the Detroit territory, with headquarters in the General Motors Building, Detroit, Mich. Mr. McCall is a graduate in mechanical engineering, Ohio State University. He was connected with the engineering department of the Gleason Works from 1922 to 1926. Since 1926 he has been connected with the engineering department of the Chrysler Corporation, his last position being that of chief engineer of the Jefferson division.

W. S. RUGG, vice-president in charge of engineering of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will have charge of the sales activities of the company in addition to the engineering activities that he has handled in the past. Mr. Rugg takes over the duties of EDWARD D. KILBURN, previously

The Best Test o

B·S

Brown &

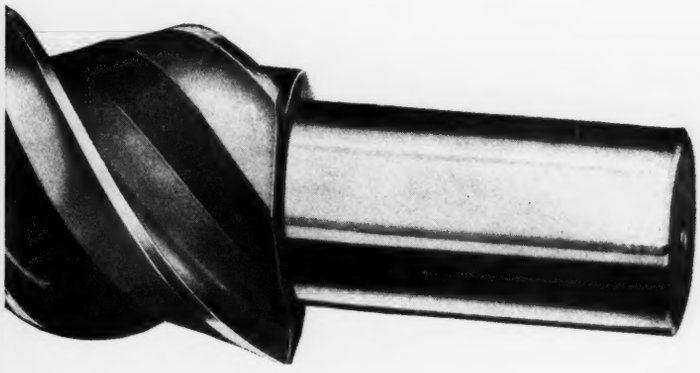
Lower Pr

# of Cutter Value

— *Your Production Records*

Cutter performance is indicated on your production records very definitely. Here, good cutters, through their ability to reduce the frequency of sharpening, show in positive figures increased productive time of men and machines.

Brown & Sharpe Cutters will consistently improve your production schedule. They will allow you to push machine work to the utmost and to maintain production at a high, even level. Catalog No. 31, listing a complete line of cutters, sent on request. Brown & Sharpe Mfg. Co., Providence, R. I.



The Cost of
Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

—

What is the Real Cost of Your Cutters?

Sharpe Cutters

Production Costs

vice-president and general sales manager, who has resigned to engage in private business. S. M. KINTNER, director of the Westinghouse research laboratory, has been made assistant vice-president and will assume engineering department duties under Mr. Rugg's direction.

OBITUARIES

ERNST KRAUSE, president of Ernst Krause & Co., A. G., of Vienna, Austria, Berlin, Germany, and Prague, Czechoslovakia, died March 30 in Vienna at the age of sixty-two. Mr. Krause formed Ernst Krause & Co. twenty-five years ago, developing the company until it became one of the important dealers in machinery and shop equipment on the European continent. He also engaged in the manufacture of machine tools and accessories. Mr. Krause held important positions in the industrial associations and chambers of commerce of Austria at various times and was the recipient of many honors by the government of his country.

W. H. FREET, assistant sales manager of the Chambersburg Engineering Co., Chambersburg, Pa., died April 26. Mr. Freet was born on August 12, 1881. He became connected with the Chambersburg Engineering Co. in 1900 as private secretary to the president, H. E. Derbyshire. In 1910, he was made purchasing agent, and in 1928, became assistant sales manager.

WHY ARE OBSOLETE MACHINE TOOLS USED?

Commenting on the editorial "Why are Obsolete Machines Used?" in April MACHINERY, an engineer who has had a great deal to do with the placing of contracts for ordnance material with manufacturers writes us as follows:

"I wish a plan could be worked out by means of which manufacturers that expect to bid on government contracts could be made acquainted with modern machine tools to be used for supplementing their normal equipment. I find that it is not at all unusual to have machine tools specified (as needed to supplement the equipment) which have been obsolete for several years. This leads me to suspect that in many cases even new equipment is bought that is not best suited for the purpose for which it is to be used.

"I have suggested in a number of cases that the machine tool industry might be able to offer valuable assistance in the matter of selecting equipment for manufacturers who expect to bid on government contracts. The suggestion has never had a warm reception. I rather feel that plant executives are afraid to let a representative of the machine tool industry come in and survey their plants, because it might be found that a great deal of the equipment is obsolete and an effort would be made to sell them some more up-to-date machines."

NEWS OF THE INDUSTRY

MICHIGAN TOOL CO. announces the opening of a new factory and office building at 7171 Six Mile Road, East, Detroit, Mich.

MARQUETTE TOOL & MFG. CO., Chicago, Ill., manufacturer of pneumatic cushions, has moved from 1900 N. Kilbourn Ave. to 6500 W. 65th St.

H. D. CONKEY & CO., Mendota, Ill., have changed the name of their manufacturing division to Conco Crane & Engineering Works, Division of H. D. Conkey & Co.

MATERIAL AND EQUIPMENT INSPECTION BUREAU, 332 S. Michigan Ave., Chicago, Ill., has been organized to serve as inspecting, purchasing, and liquidation engineers.

BAKER BROS., INC., Toledo, Ohio, has appointed the State Machinery Co., Inc., 521 Illinois Building, Indianapolis, Ind., representative of the company in the Indiana territory.

BUNTING BRASS & BRONZE CO., Toledo, Ohio, has moved its Chicago branch sales office and warehouse from S. Michigan Ave. to new and larger quarters at 1221 W. Washington Blvd.

FEDERAL PRESS CO., Elkhart, Ind., announces that the company has appointed Homer Strong & Co., Inc. of Rochester and Buffalo, N. Y., exclusive representatives in these territories.

PALMER-BEE CO., Detroit, Mich., manufacturer of conveyors, announces that the company has opened a district sales office in New York City, at 30 Church St., with H. W. Ruth in charge.

HILL CLUTCH MACHINE & FOUNDRY CO., Breakwater Ave., Cleveland, Ohio, announces that the New York office of the company has been reopened. A. L. Whiteside will be engineer in charge.

ST. JOHN X-RAY SERVICE CORPORATION, 505 Fifth Ave., New York City, has been organized by Ancel St. John and Herbert R. Isenburger to carry on the X-ray inspection business hitherto conducted by them.

COLONIAL TOOL CO., 8432-8510 Butler Ave., Detroit, Mich., announces the removal of the company's offices and factory to 147 Jos. Campau Ave. In the future the company will be known as the COLONIAL BROACH CO.

UNIVERSAL GEAR CORPORATION, 327 S. LaSalle St., Chicago, Ill., has been formed to manufacture Heliocentric speed reducers, Revocentric speed reducers, the Pitter variable gear, the Pitter clutch, and other variable-speed devices.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., announces the removal of its Baltimore office to 913 Lexington Bldg. H. D. Alexander is in charge of this office, and Harry E. Reese handles the sales of Link-Belt power transmission equipment.

OHIO STEEL FOUNDRY CO. of Lima and Springfield, Ohio, has purchased the steel foundry department and steel castings business of the Industrial Brownhoist Corporation. The steel foundry is located at Bay City, Mich., and will continue to be operated in that city.

JOHN B. STEVENS, INC., has moved from 27 Cleveland Place, New York City, to 304 Hudson St., where better facilities are available for taking care of inquiries for the line of machine tools and attachments made by this company, as well as for the line formerly made by the Garvin Machine Co.

TIMKEN ROLLER BEARING CO., Canton, Ohio, elected the following officers at a recent meeting of the board of directors: Chairman, H. H. Timken; president, M. T. Lothrop; vice-presidents, W. R. Timken, J. G. Obermier, J. W. Spray, H. J. Porter, T. V. Buckwalter, and L. M. Klinedinst; and secretary-treasurer, R. C. Brower.

FAFNIR BEARING CO., New Britain, Conn. has appointed Group Parts, Inc., 222 Harrison St., Syracuse, N. Y., distributor of Fafnir products in the Syracuse territory. The Southern Bearings & Parts Co., Birmingham, Ala., has been appointed distributor of Fafnir transmission equipment in the Alabama territory, succeeding the Moore-Handley Hardware Co.

PORTER-CABLE MACHINE CO., Salina and Wolf Sts., Syracuse, N. Y., has appointed Homer Strong & Co., 285 State St., Rochester, N. Y., and Ellicott Square Bldg., Buffalo, N. Y., exclusive representatives for Porter-Cable lathes in western New York state. Charles A. Carpenter, Park Building, Pittsburgh, Pa., has been appointed representative in the Pittsburgh territory.

INLAND STEEL CO., Chicago, Ill., has erected an imposing new office building at the company's Indiana Harbor Works. The building is approximately 150 by 46 feet, six stories high, and will contain the offices of the works manager, general superintendent, assistant general superintendent, production manager, and the time, purchasing, traffic, works auditing, and engineering departments.

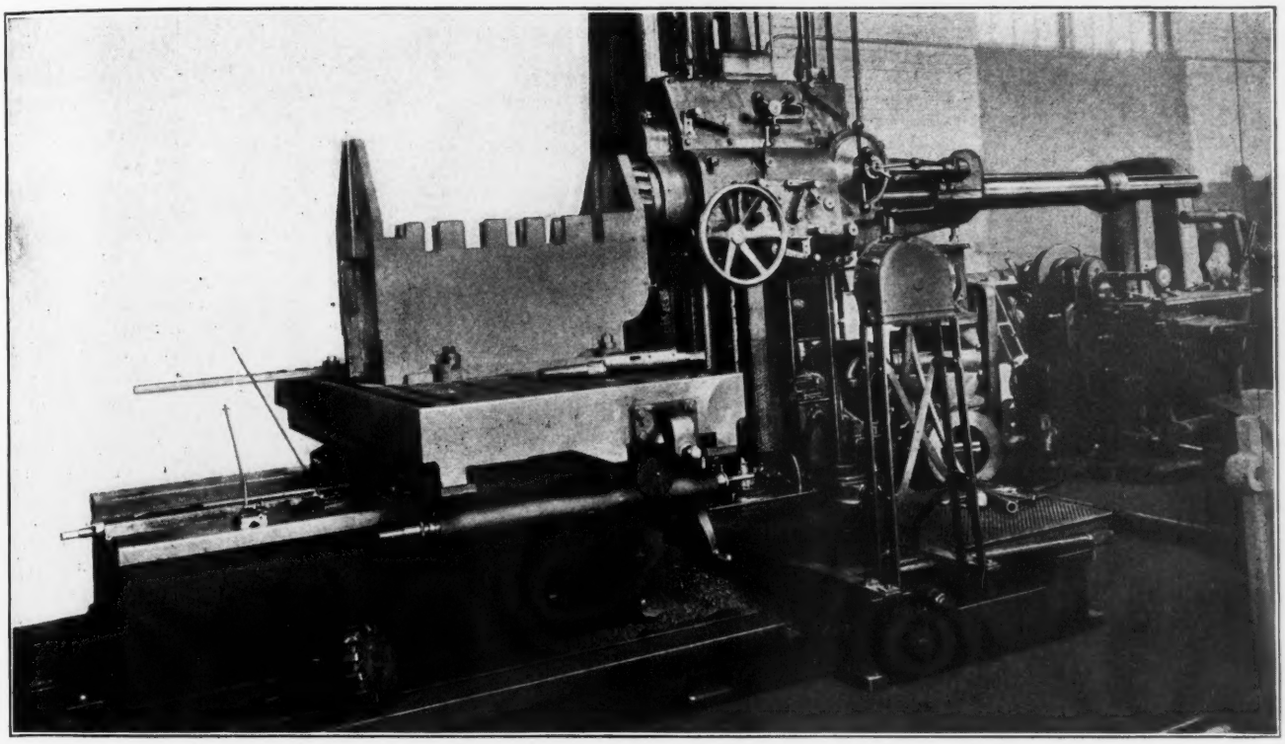
CUTLER-HAMMER, INC., 1204 St. Paul Ave., Milwaukee, Wis., has purchased the assets of the UNION ELECTRIC MFG. CO., also of Milwaukee, manufacturer of motor control apparatus. E. F. Le Noir, president of the Union Electric Mfg. Co., will become a member of the headquarters sales staff of Cutler-Hammer, Inc., and most of the other personnel of the company will join the Cutler-Hammer organization.

CLEVELAND QUARRIES CO., Cleveland, Ohio, has appointed the L. Best Co., Inc., 28 W. Broadway, New York City, export representative and domestic distributor for its line of loose and mounted grindstones in the metropolitan district. The L. Best Co. also serves as distributor of the grinding wheels manufactured by the Sterling Grinding Wheel Co., Tiffin, Ohio, a subsidiary of the Cleveland Quarries Co.

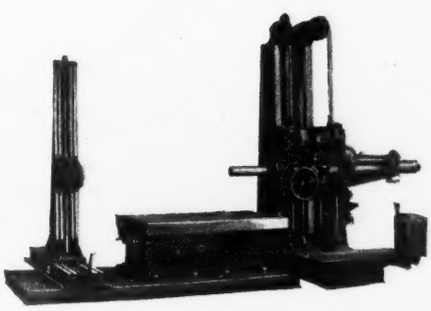
UNION CARBIDE CO., 205 E. 42nd St., New York City, announces the completion of an eleven-story building at 910 Baltimore Ave., Kansas City, Mo., in

OHIO

HORIZONTAL BORING, DRILLING & MILLING MACHINES



Reduces Time More Than 40%—



Floor Type Ohio Horizontal Boring, Drilling and Milling Machine, equipped with compound table.

It used to take 12 hours and 42 minutes floor-to-floor time on the job shown above. Now the Green Bay Barker Machine & Tool Co., Green Bay, Wis., handle the work in 7 hours and 32 minutes on this floor type Ohio Horizontal, equipped with a compound table—a saving of more than 40% in time. The job, facing and cutting slots on all four sides of the grinder pocket (used on paper mill machinery) is quickly and accurately handled by the one machine; set-up is greatly simplified.

Other Ohio Horizontals are showing equally good records both in saving of time and in accuracy of work. Let us send you data on any jobs you are interested in. Ohio Horizontals are built in all standard types and sizes.

THE OHIO MACHINE TOOL COMPANY, KENTON, OHIO

General Distributors

JOSEPH T. RYERSON & SON, INC.

Chicago, Jersey City, Boston, Buffalo, Philadelphia, Cleveland, Detroit, Cincinnati, Milwaukee, Minneapolis, St. Louis, Tulsa, Kansas City, Denver. *Representation in:* New York, Pittsburgh, Grand Rapids, Houston, Los Angeles, Syracuse, Richmond, Duluth, Dallas, San Francisco.

which the Kansas City offices of the various units of the Union Carbide & Carbon Corporation will be consolidated. These units include the Linde Air Products Co., the Prest-O-Lite Co., Inc., the Oxweld Acetylene Co., and the Union Carbide Sales Co.

BROWN INSTRUMENT CO., 4485 Wayne Ave., Philadelphia, Pa., manufacturer of pyrometers and indicating, recording, and controlling instruments, announces that the Chicago sales office and the Midwestern factory branch have been consolidated and are now located in new quarters at 155 E. Superior St., Chicago, Ill. The new location provides practically double the space formerly available for the company's business in this district.

CHAIN BELT CO., Milwaukee, Wis., has moved its New York office from 50 Church St. into new and larger quarters in the Chrysler Building, 405 Lexington Ave., New York City. The New York office looks after both the Chain Belt Co.'s line of Rex conveyors, chain, transmission, etc., and the products of the Stearns Conveyor Co., Cleveland, Ohio, (a division of the Chain Belt Co.) which include belt conveyors and bulk material storage systems. W. H. Quinn is New York district manager.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., at a recent meeting of the board of directors elected the following officers for the ensuing year: A. W. Robertson, chairman of the board; E. M. Herr, vice-chairman; F. A. Merrick, president; L. A. Osborne, Charles A. Terry, H. P. Davis, H. D. Shute, H. T. Herr, Walter Cary, W. S. Rugg, James C. Bennett, T. P. Gaylord, Harold Smith, J. S. Tritle, vice-presidents; H. F. Baetz, treasurer and assistant secretary; Warren H. Jones, secretary and acting assistant treasurer.

C. J. TAGLIABUE MFG. CO., 18 Thirty-third St., Brooklyn, N. Y., manufacturer of indicating, recording, and controlling instruments, is erecting a new plant on Park Ave., extending from Nostrand Ave. to Sanford St. The building will be a five-story structure and will provide approximately 300,000 square feet of working floor space. A completely equipped hospital will be one of the features of the new plant, and a generous allotment of space has been made for laboratories and experimental divisions. It is expected that the plant will be ready for occupancy about July 1.

AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill., announces that the SOUTHERN MANGANESE STEEL CO. has become part of the company. An office has been opened in the Law and Finance Building, Pittsburgh, Pa., in charge of W. G. Hoffman to handle the sale of "Amsco" manganese steel and "Fahralloy" heat- and corrosion-resisting castings. It is also announced that John H. Coghlan is now the company's representative in the New England states for the sale of "Amsco" manganese steel castings. Mr. Coghlan's office will be at 92 Broadway, Kendall Square, Cambridge, Mass.

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., announces that the WAYNE TOOL CO., the H. R. KREUGER CO., the WOLVERINE SCREW CO., and the CONTINENTAL TOOL WORKS, all of Detroit, have been acquired by the company. The Wayne Tool Co. is engaged in the design and manufacture of dies, tools, fixtures, and special machines; the H. R. Kreuger Co., in the design and manufacture of multiple tooling equipment; and the Wolverine Screw Co., in the making of automatic screw machine products. The Continental Tool Works manufacture metal cutting tools for the automotive industry. A new building added to the present plant of the Ex-Cell-O Aircraft & Tool Corporation will be occupied by the Wayne Tool and Kreuger divisions. The other companies will occupy their present plants.

SURFACE COMBUSTION CO., 2375 Dorr St., Toledo, Ohio, manufacturer of heat-treating equipment, announces that on May 1 the Pittsburgh branch of the company and the Mantle Recuperator Division were consolidated, and now occupy new offices at 617-619 Henry W. Oliver Building. The Mantle Engineering Co. was purchased by the Surface Combustion Co. last year, but up to the present time has been located in its old office. There will be no change in personnel; A. L. Hollinger remains Pittsburgh manager for Surface Combustion industrial equipment, and G. D. Mantle is in charge of recuperator sales. It is also announced that an expansion program is being planned which will include the extension of the present factory and office buildings at Toledo, Ohio, and the purchase of five acres of adjoining property. The development department in which research on new equipment and investigation of furnace design is carried on will have a separate building, approximately doubling the space occupied at present.

ENGINEERS DEFEND THE MACHINE AGE

TOWARD CIVILIZATION. Edited by Charles A. Beard. 307 pages, 6 by 9 inches. Published by Longmans, Green & Co., New York City. Price $3.

This is a book in which manufacturers and engineers will find much of interest. It is the engineer's answer to the questions raised by leaders of current thought who appear to doubt the true values in a machine civilization such as ours. The book is likely to become a classic in its field, dealing as it does with fundamental problems in a thorough-going manner. It is not the work of one man, but contains the thoughts of sixteen engineers, among whom Ralph E. Flanders, Dexter S. Kimball, Elmer A. Sperry, and Roy V. Wright are particularly well known to the mechanical industries.

The chapter "The New Age and the New Man," by Ralph E. Flanders, manager of the Jones & Lamson Machine Co., and the one on "Modern Industry and Management," by Dean Kimball of Cornell University, practically summarize the conclusions reached by the contributing authors throughout the work; and, therefore, these chapters may be selected to indicate the ground covered. The effect of engineering, science, and invention on modern civilization is briefly reviewed. It is shown that engineering has made possible, through the ease by which the necessities of life may be produced in abundance, a civilization, the satisfactions of which may be shared by all rather than by a few. A vivid picture is painted of the possibilities that are still ahead if engineers and industrial managers direct their efforts into the right channels.

Engineering and business are gradually being placed on a higher ethical level, and the social service of business enterprises is becoming more and more the measuring rod by which they are evaluated. The responsibilities of the leaders of great engineering enterprises are shown to be confined not to mere business success — or even engineering success. Normal business relations in this engineering age may and should result in advantages to all concerned. "It has become overwhelmingly true," says Mr. Flanders, "that the great material rewards come from cooperation, rather than from exploitation."

All the engineers who have contributed to this work come to the conclusion that the machine age, as we now see it, opens up possibilities not only for material well-being, but for true culture—not for the few but for the many.

A book of this kind was needed at the present time. An answer by engineers to the critics of the achievements of their profession should serve a useful purpose both within and without engineering circles. The engineer himself will obtain a new conception of the dignity of his work and of the ultimate purpose of his efforts.

* * *

COURSE IN GAS ENGINEERING

The University of Illinois, Urbana, Ill., in cooperation with the Illinois Gas Association, has established a brief course in the application of gas to industry. Among other subjects, this course will deal with the general principles of metallurgy and problems of carburizing, heat-treating and annealing, principles of furnace design, and furnace efficiency. The course will be given at the University, June 16 to 28. Applications for enrollment may be sent to George Schwaner, secretary of the Illinois Gas Association, 405 Mine Workers Building, Springfield, Ill.

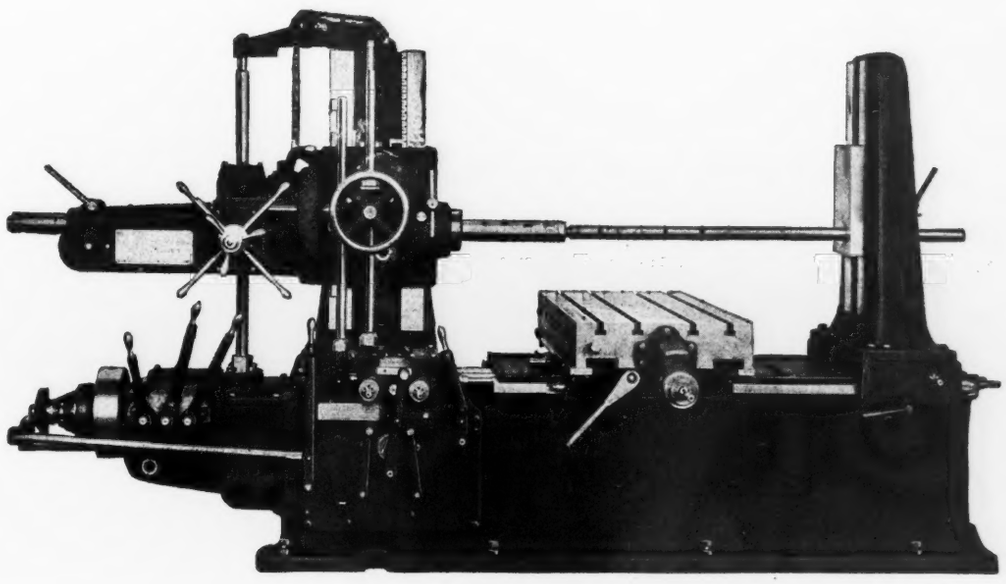
Anyhow, we are not tied down to large JIGS, the cost of which MIGHT hold us back from making the

"PRECISION"

BORING, DRILLING AND

MILLING MACHINE

better when we saw the way to do so.



The "PRECISION" is a Jig in Itself

and is the kind of big jig we can use in our own factory (and so do many others)

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

COMING EVENTS

JUNE 6-7—Annual convention of the National Association of Foremen to be held in the Civic Auditorium and the Chamber of Commerce Building, Toledo, Ohio. Henry J. Baumker, convention secretary, 316 Tenth St., Toledo, Ohio.

JUNE 9-12—Semi-annual meeting of the American Society of Mechanical Engineers at Hotel Book-Cadillac, Detroit, Mich. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 12-14—Third national meeting of the Oil and Gas Power Division of the American Society of Mechanical Engineers to be held at Pennsylvania State College, State College, Pa. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 16-25—Second World Power Conference to be held in Berlin, Germany. For further information, address Calvin W. Rice, secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City, or Weltkraft, Ingenieurhaus, Berlin NW7, Germany.

JUNE 18-25—Annual meeting of the Mechanical Division, American Railway Association, in the new auditorium at Atlantic City, N. J. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

JUNE 18-25—Exposition of railway supplies and equipment to be held under the auspices of the Railway Supply Manufacturers' Association at Atlantic City, N. J. J. D. Conway, secretary-treasurer, 1841 Oliver Building, Pittsburgh, Pa.

JUNE 23-27—Annual meeting of the American Society for Testing Materials at Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

JUNE 26-28—Convention of the Steel Founders' Society of America, Inc., at the Greenbrier Hotel, White Sulphur Springs, W. Va. Granville P. Rogers, managing director, 420 Lexington Ave., New York City.

AUGUST 24-29—Third International Congress of Applied Mechanics to be held at the Royal Technical Institute, Stockholm, Sweden. Further information may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 22-26—Annual convention of the American Society for Steel Treating at the Stevens Hotel, Chicago, Ill. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 22-26—Twelfth Annual National Metal Exposition under the auspices of the American Society for Steel Treating at the Stevens Hotel, Chicago, Ill. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 22-26—National Metal Congress at the Stevens Hotel, Chicago, Ill., in conjunction with the annual convention of the American Society for Steel Treating and the annual fall meetings of the Metals Division and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers; the Iron and Steel Division and the Machine Shop Practice Division of the American Society of Mechanical Engineers; and the American Welding Society.

OCTOBER 9-10—Production Meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. R. S. Burnett, director, production activities, Society of Automotive Engineers, 29 West 39th St., New York.

OCTOBER 15—Annual meeting of the Gray Iron Institute in Cleveland, Ohio. Manager, A. J. Tuscany, Gray Iron Institute, Cleveland, Ohio.

DECEMBER 1-6—Ninth National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

DECEMBER 1-6—Fifty-first annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

FEBRUARY 16-20, 1931—Second National Western Metal Congress and Exposition to be held in the Civic Auditorium, San Francisco, Calif., under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SOCIETIES, SCHOOLS AND COLLEGES

DREXEL INSTITUTE, 32nd and Chestnut Sts., Philadelphia, Pa. Catalogue for 1930-1931, containing calendar, outline of courses, lists of students, etc.

OHIO MECHANICS INSTITUTE, Cincinnati, Ohio. Bulletin announcing summer courses from June 23 to August 1 in a number of subjects, including mathematics, freehand drawing, patternmaking, and machine shop practice.

POLYTECHNIC INSTITUTE OF BROOKLYN, 99 Livingston St., Brooklyn, N. Y. Bulletin containing outline of evening courses for the term 1930-1931. Seventy-fifth annual catalogue (1930-1931), containing calendar, outline of courses, list of students, etc.

UNIVERSITY OF CINCINNATI, Cincinnati, Ohio. Bulletin entitled, "The Cooperative System of Education," outlining this system as carried out by the university. Bulletin containing announcement of cooperative courses in the College of Engineering and Commerce for the year 1930-1931.

NEW BOOKS AND PUBLICATIONS

BISMUTH. Circular of the Bureau of Standards No. 382. 41 pages, 6 by 9 inches. Published by the Government Printing Office, Washington, D. C. Price, 10 cents.

INDUSTRIAL SHOP LIGHTING. 12 pages, 8 1/2 by 11 inches. Published by the National Safety Council, Civic Opera Building, 20 N. Wacker Drive, Chicago, Ill., as Safe Practices Pamphlet No. 22.

HACKSAW BLADES. Simplified Practice Recommendation of the Bureau of Standards R90-29. 14 pages, 6 by 9 inches. Published by the Government Printing Office, Washington, D. C. Price, 10 cents.

STANDARDS YEAR BOOK (1930). 301 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 106 of the Bureau of Standards. Price, 75 cents.

SAFETY ADVERTISING. 16 pages, 5 1/4 by 7 3/4 inches. Distributed by the Metropolitan Life Insurance Co., 1 Madison Ave., New York City, as Industrial Safety Pamphlet No. 6 of the Policyholders Service Bureau.

THE COMMERCIAL STANDARDS SERVICE AND ITS VALUE TO BUSINESS. Commercial Standard Publication CSO-30. 34 pages, 6 by 9 inches. Published by the Government Printing Office, Washington, D. C. Price, 10 cents.

PLAIN AND THREAD PLUG AND RING GAGE BLANKS. 45 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 100 of the Bureau of Standards. Price, 15 cents.

CHART FOR DETERMINING THE HELIX ANGLES OF SCREW THREADS. By I. H. Fullmer. Distributed by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 109 of the Bureau of Standards. Price, 5 cents.

STUDIES IN THE ELECTRODEPOSITION OF METALS. By Donald B. Keyes and Sherlock Swann, Jr. 20 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 206 of the Engineering Experiment Station. Price, 10 cents.

RELIABILITY OF FUSIBLE TIN BOILER PLUGS IN SERVICE. By John R. Freeman, Jr., J. A. Scherrer, and S. J. Rosenberg. 22 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. 129. Price, 10 cents.

A STUDY OF THE IKEDA SHORT TIME (ELECTRICAL RESISTANCE) TEST FOR FATIGUE STRENGTH OF METALS. By Herbert F. Moore and Seichi Konzo. 34 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 205 of the Engineering Experiment Station. Price, 20 cents.

A NEW DEAD-WEIGHT TESTING MACHINE OF 100,000 POUNDS CAPACITY. By L. B. Tuckerman, Herbert L. Whittemore and Serge N. Petrenko. 18 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C. as Research Paper No. 147 of the Bureau of Standards. Price, 5 cents.

STOP WASTE! 16 pages, 8 1/2 by 10 1/2 inches. Distributed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

This booklet contains a description of the methods employed by the Westinghouse Electric & Mfg. Co. in conducting a campaign for waste elimination. It is illustrated with photographs of exhibits that have been used in the shops to demonstrate how waste can be reduced.

PRESENT STATE OF CYLINDER TESTING. By F. Eder. 14 pages, 6 by 9 inches. Published by Robert W. Hunt Co., 2200 Insurance Exchange, Chicago, Ill.

This publication consists of a paper presented at a recent meeting of the Compressed Gas Manufacturers Association. The author is an engineer with the Robert W. Hunt Co., who has given the subject of cylinder testing a great deal of attention. New methods in cylinder testing are discussed and the entire subject of strength of cylinders is very thoroughly dealt with.

PRINCIPLES OF AUTOMECHANICS. By Earl H. Kelsey. Edited by R. W. Selvidge. 202 pages, 6 by 9 inches; 122 illustrations. Published by the Manual Arts Press, Peoria, Ill. Price, $1.85.

This book is intended for instruction purposes in automobile repair work in junior and senior high schools and trade and evening classes. The book contains concise and definite information on a great many problems that arise in automobile repair work. It is arranged especially for use in teaching classes, being provided with question sheets, as an aid to the instructor.

WORK ROUTING IN PRODUCTION. By John Younger. 115 pages, 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price $2.50.

Little material has been published on the function of routing, scheduling, and dispatching, and this book should therefore prove of considerable interest to the production executive. It is based upon the current practice of some of the country's leading manufacturers. Throughout emphasis is laid on the ways in which the methods described can be applied to lower costs and how they can be fitted to widely varying conditions. Fundamental principles are carefully explained and many examples are given to show how these principles are applied and what results can be expected.

TRADE ASSOCIATIONS—THEIR SERVICES TO INDUSTRY. By Joseph Henry Foth. 338 pages, 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

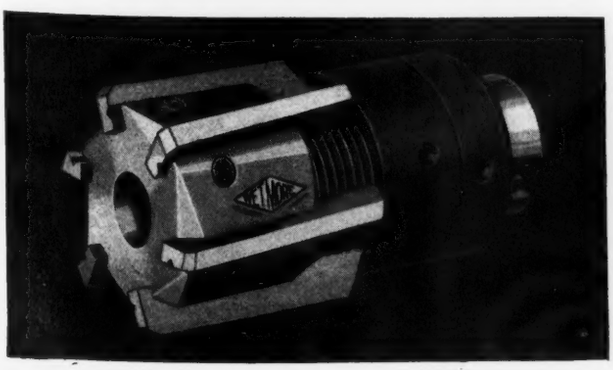
A vast field for constructive activity by trade associations opened up when the Supreme Court clarified their legal status in 1925. The growing difficulty of marketing and many other business

WETMORE

ADJUSTABLE REAMERS

Exclusive features of design and the care with which each reamer is manufactured have made Wetmore standard equipment in shops where the last word in precision is demanded. The name "Wetmore" on a reamer, like the Sterling mark on silver, is your positive assurance of 100 per cent accuracy, convenience of use, and unusually long life. Send for latest catalog of all types of Wetmore Adjustable Machine and Cylinder Reamers and replacement blades.

WETMORE REAMER COMPANY
60 27th STREET MILWAUKEE, WIS.



WETMORE TYPE NO. 7 SHELL REAMER

This reamer is also adaptable for bars or arbors where one or more reamers are used at same time. Sizes range from 1¼" diameter to 6"; six, eight, ten, or twelve blades, depending on size. Left-hand angle blades prevent "digging in", chattering, and scoring while backing out.

problems confronting us today raise the question of the ability of associations to cope with these problems. A full analysis of this situation is available in this new book. It tells how business can obtain constructive help from trade associations in market research, trade extension, quality standardization, scientific research, legislation, self-regulation with the industry, etc.

DIE-CASTING PRACTICE. By Marc Stern. 270 pages, 5 1/2 by 8 inches; 128 illustrations. Published by McGraw-Hill Book Co., New York City. Price, $2.50.

Owing to the fact that only a few books have been published in the past on die-casting, the present book will doubtless prove of interest to those engaged in this field. It covers the die-casting industry and its problems in a broad manner, having chapters on the design of die-castings and of dies, die construction and die steels, the alloys used for die-casting, the production phases of die-casting, a review of die-casting machine design, finishes for die-castings, and alloying practice and control in producing die-casting materials. The book is intended not only for those directly connected with the industry, but also for those who make use of die-cast parts. The application of die-castings, the principles of design, the limitations and possibilities of the many alloys in use, and the finishes applicable for such alloys, are some of the factors of vital importance in the intelligent utilization of this comparatively new process.

THE ALUMINUM INDUSTRY. By J. D. Edwards, F. C. Frary, and Zay Jeffries. Published in Two Volumes. Volume 1, 358 pages, 6 by 9 inches; Volume 2, 870 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price per set, $12.

This extensive work comprises a complete handbook of the aluminum industry, covering all phases of the production and industrial use of this material. Volume 1 begins with a history of the discovery of aluminum and the development of the industry and then proceeds to a detailed discussion of the ores of aluminum and their mining and refining for the production of pure alumina. It also describes the production of metallic aluminum. Volume 2 discusses the properties of aluminum and its alloys, the fabrication of aluminum products, and their use in the industries. Owing to the widespread interest in the fabrication and use of aluminum and to the lack of comprehensive material on the subject previously available, this work should prove of timely interest.

MATERIALS OF ENGINEERING CONSTRUCTION. By Francis W. Roys. 331 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.

No problem presents itself more frequently to the engineer than the selection of materials for tools, machines, structures, and other engineering works. It is essential, therefore, that he acquire a working knowledge of all the engineering materials and keep in constant contact with their improvement and development. The author of this book, who is Professor of Mechanical Engineering at the Worcester Polytechnic Institute, has written it as a text for the student of engineering to acquaint him with the characteristics and properties of the more common and most widely used engineering materials. The text is divided into twelve chapters as follows: Mechanics of Materials; Wood for Structural Purposes; Lime and Plaster; Hydraulic Cements and Concretes; Structural Clay Products; Building Stone; Ferrous Metals; Non-Ferrous Metals and Alloys; Corrosion of Metals; Temperature Effects on Metals; Failure of Material Under Repeated Stress; and Varnishes and Paints.

AUTOMOBILE STEELS. By Albert Muller-Hauff and Karl Stein. Translated from the German by Hans Goldschmidt. 219 pages, 6 by 9 inches; 77 illustrations, 77 tables. Published by John Wiley & Sons, Inc., New York City. Price, $3.50.

The experience of the two authors in the plants of outstanding manufacturers of high-grade steel in Europe and America has led them to realize the need for an exchange of information and experience between the metallurgist, on the one hand, and the designer and user of steel, on the other. The present book, therefore, has been planned to bring together information relating to steels used in the automobile industry in such a manner that the book may be used as a practical manual by designers and production engineers in automobile plants, as well as by those engaged in steel manufacture. An attempt has been made to present the information in as popular a form as the subject permits, so that it will appeal to anyone engaged in the industry who is seeking information on the subjects dealt with. The book covers the testing of materials; metallography; the manufacture of automobile steels and their characteristics; the selection of steels for various parts of automobiles; standardization of automobile steels; failures; and steel analysis of automobile parts.

NEW CATALOGUES AND CIRCULARS

STEEL TIES. Carnegie Steel Co., Pittsburgh, Pa. Catalogue containing data on railway steel cross-ties.

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Circular showing application of steel castings to hoists.

STEAM TURBINES. Murray Iron Works Co., Inc., Burlington, Ia. Circular illustrating Murray turbines for generator units.

HOISTS. American Engineering Co., 2435 Aramingo Ave., Philadelphia, Pa. Circular illustrating and describing "Lo-Hed" hoists.

ELECTRIC EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Catalogue covering Crouse-Hinds automatic synchronous timing switches.

CONVEYORS. Palmer-Bee Co., Detroit, Mich. Catalogue of conveyors, showing photographs of actual installations and details of construction.

ROLLER BEARINGS. Hoover Steel Ball Co., Ann Arbor, Mich. Circular entitled "Why?" illustrating and describing Hoover tapered roller bearings.

ELECTRIC FURNACES. Ajax Metal Co., Frankford Ave. and Richmond St., Philadelphia, Pa. Catalogue illustrating and describing electric furnaces.

HEATING EQUIPMENT. American Blower Corporation, Detroit, Mich. Bulletin 9218, outlining the Venturafin method of heating, and equipment employed.

FURNACES. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular 26, illustrating and describing Homo tempering furnaces for bolts and screws.

ELECTRIC MOTORS. Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio. Circular illustrating and describing Type AA Form L across-the-line motors.

ELECTRIC FURNACES. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 530, illustrating and describing electric rotary retort furnaces for pressure carburizing.

ELECTRIC MOTORS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Bulletin 13, illustrating and describing Century multi-speed squirrel-cage induction polyphase motors.

MACHINISTS' SMALL TOOLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Pocket catalogue of high-speed and carbon steels drills, reamers, cutters, taps, and dies.

ELECTRIC MOTORS. Electro Dynamic Co., Bayonne, N. J. Bulletin 262, illustrating and describing the company's new direct-current motor known by the trade name "Weld-Built."

DIE SETS. U. S. Tool Co., Inc., Ampere, N. J. Catalogue of die sets and accessories, containing illustrations and tables of prices, weights, and dimensions of the various styles.

ELECTRIC FURNACES. H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa. Bulletin 190, descriptive of Falcon straight-line continuous electric furnaces for heat-treating strip metal and wire.

LAMPS AND SAFETY CIRCUIT EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Bulletins 2208 and 2219 containing data on vaporproof portable hand lamps, and ground-ulets, respectively.

GRINDING AND POLISHING MACHINERY. Hammond Machinery Builders, Inc., Kalamazoo, Mich. Bulletin 20, illustrating and describing the new Hammond grinders and polishers with motor air cleaner.

ELECTRIC FURNACES. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 430, covering eighteen standard sizes of Box type electric heat-treating furnaces. Complete descriptions and specifications are included.

PRECISION BALANCING EQUIPMENT. Gisholt Machine Co., Madison, Wis. Service bulletins 24, 33, and 38, illustrating, respectively, the balancing of crankshafts, tractor belt pulleys, and automobile clutches.

BENDING AND STRAIGHTENING MACHINES. Kane & Roach, Inc., Syracuse, N. Y. Leaflet entitled "Built by Specialists," illustrating various types of bending, straightening, and forming machines made by this concern.

AUTOMATIC LATHES. Gisholt Machine Co., Madison, Wis. Service bulletins 29, 30, and 34, treating, respectively, of the machining of crowned pulleys; roughing out tractor bull gears; and tungsten-carbide and the Simplimatic.

TESTING MACHINERY. Southwark Foundry & Machine Co., 400 Washington Ave., Philadelphia, Pa. Circular illustrating and describing the Oxweld portable testing machine, especially adapted for tensile tests of welded joints.

STEAM TURBINES. General Electric Co., Schenectady, N. Y. Bulletin GEA-1011A, describing the general principles, construction, and operation of General Electric steam turbines for supplying power to industrial plants and central stations.

NICKEL CAST IRON. International Nickel Co., Inc., 67 Wall St., New York City, has brought out a monthly publication called *Nickel Cast Iron News*, containing items of interest relating to nickel cast iron and its various applications.

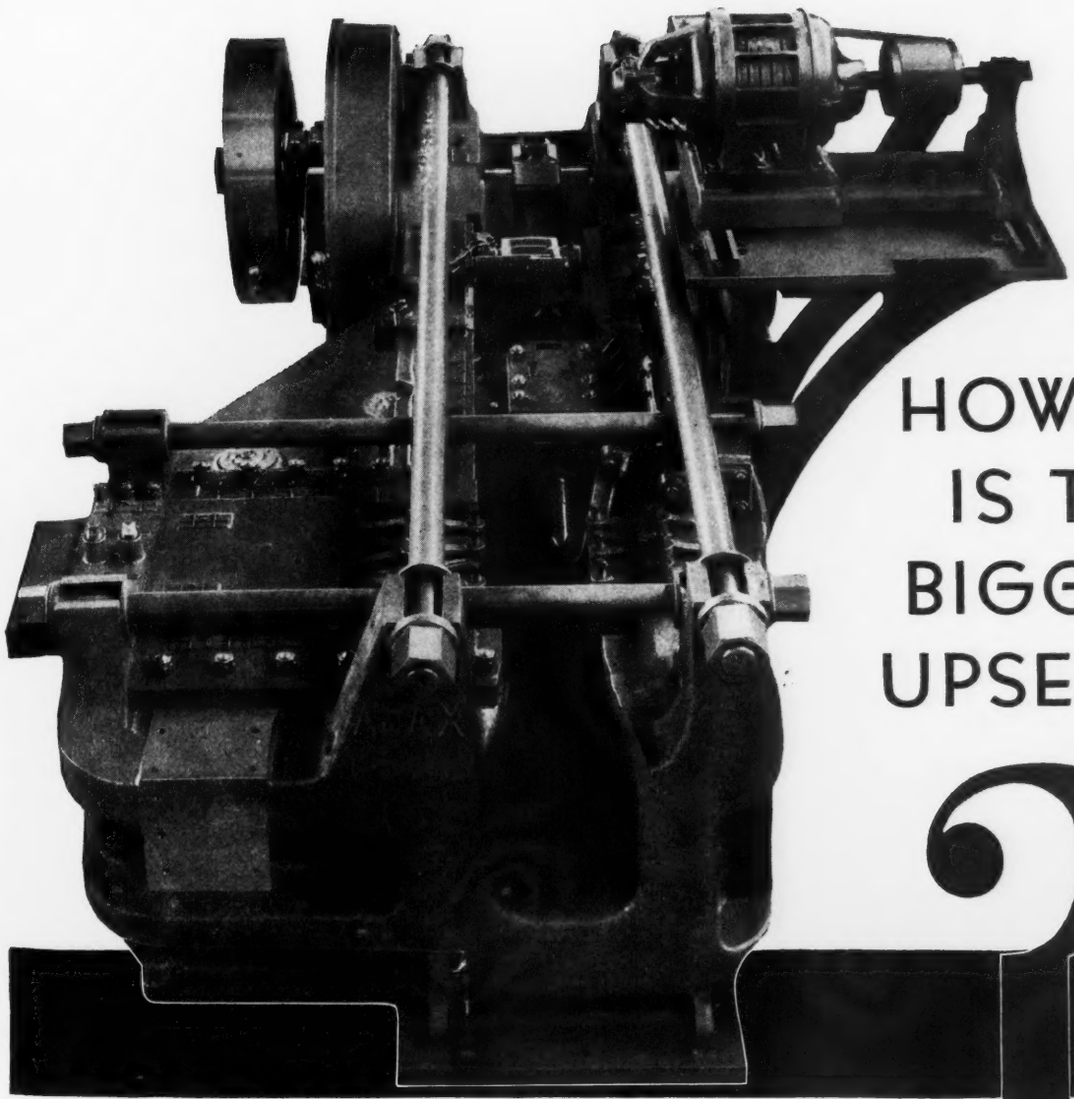
SMALL TOOLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Circular illustrating the chemical and physical testing laboratories maintained by the company to insure high quality in Morse drills, reamers, cutters, and other small tools.

ELECTRIC FURNACES. Ajax Electrothermic Corporation, Trenton, N. J. Bulletin 6, describing various installations of Ajax-Northrup coreless or high-frequency induction furnaces. The characteristics of these furnaces are described and tables of sizes are included.

WIRE FORMING MACHINES. Baird Machine Co., Bridgeport, Conn. Bulletin 100, illustrating and describing in detail the Baird four-slide wire and ribbon metal forming machines. The various types of machines are illustrated, as well as examples of work for which they are adapted.

AUTOMOTIVE PRODUCTS. Bendix Aviation Corporation, New York Central Bldg., New York City. Circular illustrating Bendix automotive and aviation products, including the Bendix drive, Stromberg carburetors, Bendix-Cowdrey brake testers and Eclipse aviation engine starters and generators.

ELECTRIC EQUIPMENT. Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. Bul-



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THIS 410,000-pound Ajax Super Upsetter, the largest and most powerful machine of this type ever built, was completed in December, 1929, and delivered in January, 1930, to Spang, Chalfant & Co., Inc., Pittsburgh.

Clean-cut simplicity of design, rigidity and ruggedness of working parts makes this like all other Ajax—the most dependable of Upsetting Forging Machines.

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1917 - 280,000 pounds
1924 - 340,000 pounds
1925 - 385,000 pounds
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SUPER UPSETTERS

letin 830, illustrating and describing automatic pressure switches used in connection with automatic control for compressors, pumps, and other equipment not employing pressures greater than 150 pounds per square inch.

HEAT MEASURING INSTRUMENTS. R. Y. Ferner Co., Investment Bldg., Washington, D. C. Catalogue D-1, illustrating and describing Chevenard industrial thermal analyzers and differential dilatometers for the thermal study of steels, alloys, and various other products, such as refractories, glass, etc.

HYDRAULIC PUMPS. Lapointe Machine Tool Co., Hudson, Mass. Catalogue describing the mechanical details of the West hydraulic pump, which is of the multiple piston type, and is built for both constant and variable delivery. Tables listing the capacity of the various types and sizes are included.

ELECTRIC SOLDERING IRON HEATER. Bellevue Industrial Furnace Co., 2971 Bellevue Ave., Detroit, Mich. Circular illustrating a new electric soldering iron heater for manufacturing plants and repair shops. In view of the high operating temperatures possible with this device, it is also suitable for laboratory purposes.

ALLOY STEELS. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin containing the reprint of a paper on "Alloy Steels in the Railroad Field," by Charles McKnight, which was presented before the Railroad Division of the American Society of Mechanical Engineers at the annual meeting in December.

MACHINISTS' TOOLS. Lufkin Rule Co., Saginaw, Mich., (with eastern office and warehouse at 106 Lafayette St., New York City). Catalogue 6, covering micrometers; calipers; dividers; combination squares; steel scales; depth, thickness, radius, and screw pitch gages; hook rules; bevels; center-punches; and steel reference tables.

MANGANESE STEEL. American Manganese Steel Co., Chicago Heights, Ill. Bulletin illustrating the application of Amsco manganese steel in the production of crawler links and sprockets used on Holt and Best tractors. Bulletin illustrating the use of manganese steel in railway track members, such as crossings, frogs, switch points, etc.

SPEED REDUCERS. Universal Gear Corporation, 327 S. LaSalle St., Chicago, Ill. Bulletin H-1, illustrating and describing the Heliocentric speed reducer, a device developed in England, which has just begun to be manufactured in the United States. This speed reducer differs in principle in a marked degree from the regular speed reducers generally used.

POWER PRESSES. Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Catalogue covering the line of H-P-M hydro-power presses which are adapted for all heavy pressing operations. The catalogue outlines the operating advantages of these presses and describes the performance characteristics and construction details. The standard sizes and capacities are tabulated.

COMBINATION MACHINE TOOL. Production Engineering Co., West 1848 Broadway, Spokane, Wash. Circular illustrating the Multimechanic, some of the features of which have been redesigned. The machine is built in both heavy- and light-duty types and is suitable for milling, drilling, boring, and turning. Tooling lay-out sheets for work performed on the Multimechanic are also included.

TOOL GRINDERS. George Scherr Co., Inc., 144 Liberty St., New York City. Catalogue illustrating and describing an automatic hob and tool grinder designed for the accurate grinding of all kinds of milling cutters, hobs, reamers, taps, and general tool-room work. The general features of these machines are described, and a variety of operations for which they are adapted are illustrated.

STEEL. Inland Steel Co., Chicago, Ill. Booklet entitled "Inland Open-hearth Sheet-steel Products," describing each of the many grades of the company's steel sheets. Folder entitled "Inland Gal-Van-Alloy Steel Sheets," describing the company's new coated sheet steel. Folder entitled "Enduring Sheets at Low Cost," describing the company's copper alloy rust- and corrosion-resisting steel sheets.

AIR CHUCKS. Logansport Machine Co., Logansport, Ind. Catalogue S-25 entitled "Logan Air-operated Devices" illustrating and describing in detail air-operated chucks of different types, rotating and non-rotating cylinders, double-acting cylinders, and special cylinders for various purposes, as well as control operating valves, air filters, exhaust mufflers, air-operated vises, and arbor presses.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the application of the Cleveland overhead tramrail system for handling and storing bales, boxes, barrels, bags, or bundles of material and product. Circular illustrating applications of the Cleveland overhead tramrail system in the steel industry.

HEAT-TREATING EQUIPMENT. Interstate Drop Forge Co., 27th St. and Capitol Drive, Milwaukee, Wis. Bulletin entitled "Proper Heat-treatment of Forgings," outlining the heat-treatment procedure and the equipment employed to obtain the desired characteristics in "Interstate" forgings. The heat-treatment tables presented will be found of value in selecting the steel best adapted for a given service.

FLOW METERS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Revised edition of a book containing instructions for the installation and care of Brown electric flow meters. The book explains the mechanism of the various types of manometers, indicators, and recording instruments, and gives instructions for installing the equipment, adjusting the instruments for zero readings, and changing range tubes. Tables of correction factors for pressure, quality, and superheat of steam are included.

TURRET LATHES. Gisholt Machine Co., Madison, Wis. Service bulletins 14, 20, 22, 23, 28, 35, 36, 37, and 39, showing recent adaptations of Gisholt turret lathes, including machining valve bonnets with projecting stems; rolling in valve seats; machining fins of airplane engine cylinders; machining a refrigeration compressor crankshaft of unusual shape; a wide variety of chucking work; thread-cutting on heavy-duty machines; high-production heavy-duty service; machining airplane engine cylinder heads; and machining tractor wheel carriers.

HIGH-SPEED CARBON AND ALLOY TOOL STEELS. Ludlum Steel Co., Watervliet, N. Y. Catalogues covering the Ludlum line of high-speed carbon and alloy tool steels: corrosion-, heat-, and wear-resisting steels; valve steel; Strauss metal; and special-purpose steel. The catalogues describe the characteristics of these steels, contain tables of classifications, and give information on the heat-treatment of the various grades. Reference book of steel treating tabulations, containing tables of weights of rounds, squares and flats, temperature conversion tables, decimal equivalent tables, hardness ranges, etc. The company supplies a binder for conveniently assembling the various bulletins.

PRECISION LATHES. South Bend Lathe Works, 774 E. Madison St., South Bend, Ind. General catalogue 91-A, containing 108 pages, completely describing and illustrating the ninety-six different sizes and types of New Model South Bend precision lathes, with their tools and attachments. The catalogue also gives information regarding lathe construction, the proper selection of lathes for the work to be done, etc. Export information is given in English, Spanish, Portuguese, French, and German. Bulletin 18, illustrating and describing the 18-inch New Model South Bend precision lathes. Special attention is called to the tool-room precision lathe for making precision master taps, screw gages, special screws, dies, fixtures, tools, etc. Complete specifications, including dimensions and prices of the various types, are given.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for April 1, 1930.

State of New York } ss.
County of New York }

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of the Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None: Business Managers, Alexander Luchars, President, 140-148 Lafayette St., New York, Robert B. Luchars, Vice-President, 140-148 Lafayette St., New York, and Edgar A. Becker, Treasurer, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Alexander Luchars; Alexander Luchars, Trustee for Helen L. Ketchum, Elizabeth Y. Urban, and Robert B. Luchars; Nellie I. O'Neill; Louis Pelletier; and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 19th day of March, 1930.

CHARLES P. ABEL,
Notary Public, Kings County No. 228
Kings Register No. 1038
(SEAL) New York County No. 35, New York Register No. 1-A-25
(My commission expires March 30, 1931)